



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
University of Nebraska,
Conservation and Survey
Division

Soil Survey of Cheyenne County, Nebraska



How To Use This Soil Survey

General Soil Map

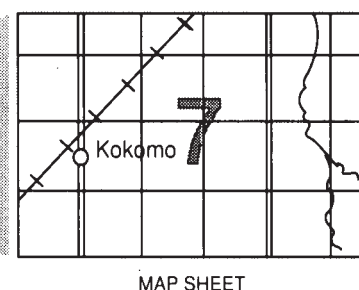
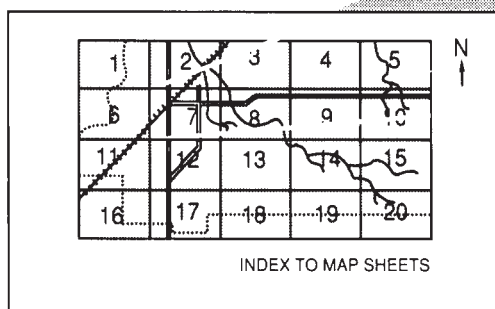
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

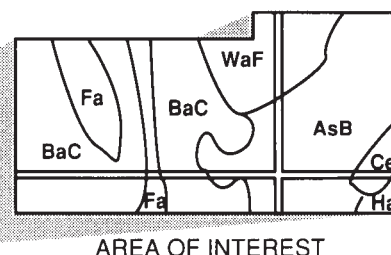
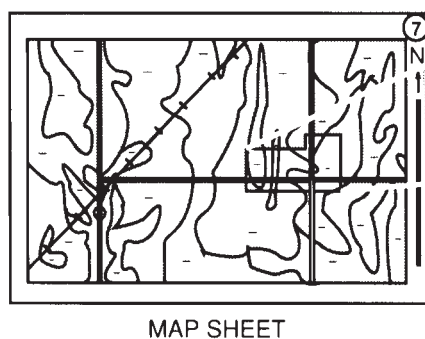
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Natural Resources Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the South Platte Natural Resources District. The South Platte Natural Resources District and the Cheyenne County Commissioners provided financial assistance to employ a soil scientist and to purchase aerial photography used in field mapping.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Windbreaks provide protection for the farmstead and stripcropping provides protection for the soils in the Alliance-Duroc-Kuma association in Cheyenne County.

Contents

Index to map units	iv	Bridget series.....	122
Summary of tables	vi	Busher series.....	122
Foreword	vii	Canyon series	123
General nature of the county	1	Creighton series	124
How this survey was made.....	5	Dix series	124
Map unit composition	6	Duroc series.....	125
General soil map units	7	Dwyer series	125
Soil descriptions	7	Epping series.....	126
Detailed soil map units	21	Glenberg series.....	126
Soil descriptions	21	Goshen series	131
Prime farmland	93	Jayem series	131
Use and management of the soils	95	Johnstown series	132
Crops and pasture	95	Keith series	133
Rangeland	98	Kuma series.....	133
Windbreaks and environmental plantings	102	Las series.....	134
Recreation	104	Las Animas series	135
Wildlife habitat.....	104	Lodgepole series	135
Native woodland	106	McCook series.....	136
Engineering	106	Mitchell series	136
Soil properties	113	Rosebud series	137
Engineering index properties	113	Satanta series	138
Physical and chemical properties	114	Sidney series.....	138
Soil and water features	115	Tassel series	139
Engineering index test data	117	Ulysses series.....	139
Classification of the soils	119	Valent series	140
Soil series and their morphology.....	119	Formation of the soils	141
Alliance series.....	119	References	145
Altvan series	120	Glossary	147
Bankard series	121	Tables	155
Bayard series.....	121	Interpretive groups	227

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Index to Map Units

Ao—Alliance loam, 0 to 1 percent slopes	21	CtC—Creighton very fine sandy loam, 3 to 6 percent slopes	49
AoB—Alliance loam, 1 to 3 percent slopes	22	DhD—Dix gravelly loam, 3 to 11 percent slopes	50
AoC—Alliance loam, 3 to 6 percent slopes	23	DhG—Dix gravelly loam, 11 to 50 percent slopes	50
AtB—Altvan loam, 1 to 3 percent slopes	24	Du—Duroc loam, 0 to 1 percent slopes	51
AtC—Altvan loam, 3 to 6 percent slopes	25	DuB—Duroc loam, 1 to 3 percent slopes	52
AvD—Altvan-Dix complex, 3 to 9 percent slopes	26	Dv—Duroc loam, terrace, gravelly substratum, 0 to 1 percent slopes	53
Bb—Bankard loamy sand, 0 to 2 percent slopes	28	Dx—Duroc silt loam, terrace, 0 to 1 percent slopes	54
Bc—Bankard loamy fine sand, channeled	28	DyE—Dwyer loamy fine sand, 9 to 17 percent slopes	55
Be—Bayard fine sandy loam, 0 to 1 percent slopes	30	ErE—Epping-Mitchell complex, 3 to 20 percent slopes	56
BeB—Bayard fine sandy loam, 1 to 3 percent slopes	30	Gd—Glenberg fine sandy loam, 0 to 2 percent slopes	58
BeC—Bayard fine sandy loam, 3 to 6 percent slopes	32	Go—Goshen silt loam, 0 to 1 percent slopes	59
BeD—Bayard fine sandy loam, 6 to 9 percent slopes	33	JmB—Jayem fine sandy loam, 1 to 3 percent slopes	60
BeE—Bayard fine sandy loam, 9 to 20 percent slopes	34	JmC—Jayem fine sandy loam, 3 to 6 percent slopes	61
Bg—Bridget very fine sandy loam, 0 to 1 percent slopes	35	Jo—Johnstown loam, 0 to 1 percent slopes	62
BgB—Bridget very fine sandy loam, 1 to 3 percent slopes	36	Ke—Keith loam, 0 to 1 percent slopes	63
BgC—Bridget very fine sandy loam, 3 to 6 percent slopes	37	KeB—Keith loam, 1 to 3 percent slopes	64
BgD—Bridget very fine sandy loam, 6 to 9 percent slopes	38	KeC—Keith loam, 3 to 6 percent slopes	65
BuC—Busher fine sandy loam, 3 to 6 percent slopes	39	Ku—Kuma loam, 0 to 1 percent slopes	67
BxD—Busher-Tassel complex, 3 to 9 percent slopes	40	Lm—Las loam, 0 to 1 percent slopes	68
ByE—Busher-Tassel complex, 9 to 20 percent slopes	42	Lw—Las Animas loam, 0 to 2 percent slopes	69
CcF—Canyon fine sandy loam, 6 to 30 percent slopes	43	Ly—Lodgepole silt loam, 0 to 1 percent slopes	70
CdG—Canyon-Rock outcrop complex, 11 to 60 percent slopes	44	Mc—McCook very fine sandy loam, 0 to 1 percent slopes	70
CeE—Canyon-Bayard complex, 6 to 20 percent slopes	46	MkC—Mitchell very fine sandy loam, 3 to 6 percent slopes	71
CtB—Creighton very fine sandy loam, 1 to 3 percent slopes	48	MkD—Mitchell very fine sandy loam, 6 to 9 percent slopes	73
		MkE—Mitchell very fine sandy loam, 9 to 20 percent slopes	74
		Pg—Pits, sand and gravel	74

ReG—Rock outcrop-Epping complex, 11 to 60 percent slopes	75
RhG—Rock outcrop-Tassel complex, 20 to 60 percent slopes	75
Ro—Rosebud loam, 0 to 1 percent slopes	76
RoB—Rosebud loam, 1 to 3 percent slopes	77
RoC—Rosebud loam, 3 to 6 percent slopes	78
RsD—Rosebud-Canyon complex, 3 to 9 percent slopes	80
Sb—Satanta loam, gravelly substratum, 0 to 1 percent slopes	81
SbB—Satanta loam, gravelly substratum, 1 to 3 percent slopes	82

SbC—Satanta loam, gravelly substratum, 3 to 6 percent slopes	83
SnC—Sidney loam, 3 to 6 percent slopes	84
SoD—Sidney-Canyon complex, 3 to 9 percent slopes	85
TbF—Tassel-Busher complex, 3 to 30 percent slopes	86
TcG—Tassel-Busher-Rock outcrop complex, 11 to 60 percent slopes	88
UyB—Ulysses loam, 1 to 3 percent slopes	89
UyC—Ulysses loam, 3 to 6 percent slopes	90
VdD—Valent loamy fine sand, 6 to 9 percent slopes	91

Summary of Tables

Temperature and precipitation (table 1)	156
Freeze dates in spring and fall (table 2)	157
Growing season (table 3)	157
Acreage and proportionate extent of the soils (table 4)	158
Prime farmland (table 5)	160
Land capability and yields per acre of crops (table 6)	161
Capability classes and subclasses (table 7)	165
Rangeland productivity and characteristic plant communities (table 8)	166
Windbreaks and environmental plantings (table 9)	174
Recreational development (table 10)	180
Wildlife habitat (table 11)	185
Building site development (table 12)	189
Sanitary facilities (table 13)	194
Construction materials (table 14)	199
Water management (table 15)	203
Engineering index properties (table 16)	208
Physical and chemical properties of the soils (table 17)	216
Soil and water features (table 18)	220
Engineering index test data (table 19)	224
Classification of the soils (table 20)	226

Foreword

This soil survey contains information that can be used in land-planning programs in Cheyenne County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of Cheyenne County, Nebraska

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United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with the University of Nebraska, Conservation and Survey Division

CHEYENNE COUNTY is in the southern part of the Nebraska panhandle (fig. 1). It borders the State of Colorado on the south, Kimball and Banner Counties on the west, Morrill County on the north, and Garden and Deuel Counties on the east. It covers an area of 765,498 acres, or 1,196 square miles. It is about 40 miles from east to west and slightly more than 30 miles from north to south.

Agriculture is the main source of income in the county. Farming, ranching, and related businesses account for most of the employment.

Most of the soils in the county are loamy and silty. They range from nearly level to very steep. Most of the soils in the county formed in material weathered from calcareous sandstone or in loess deposited over this sandstone. Most of the soils in the county are on uplands. Some of the soils in the uplands formed in sandy and gravelly alluvium. In the northern part of the county some soils formed in windblown and redeposited sandy and loamy material. On the side slopes of the major valleys, the soils are steep and formed in calcareous sandstone, calcareous siltstone, or in sandy and gravelly colluvium. The soils in the valleys formed mainly in calcareous alluvium, colluvium, or both. Soil blowing and water erosion are the main hazards affecting the soils on uplands. Occasional flooding is a hazard in some areas of the soils in the valleys. Insufficient rainfall for crops is a management concern in most years. Conserving water and maintaining fertility are major concerns in management. Proper design of

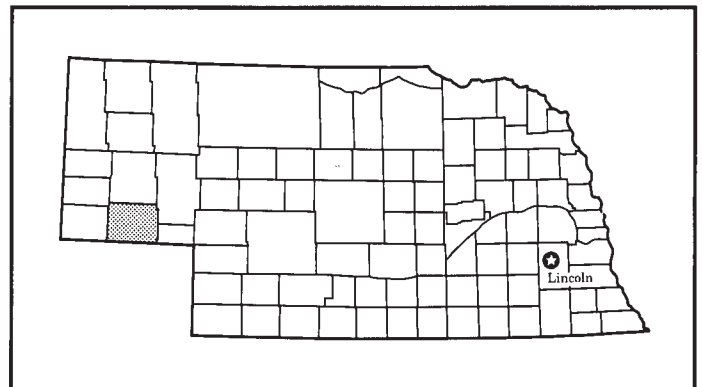


Figure 1.—Location of Cheyenne County in Nebraska.

irrigation systems and efficient use of water are important concerns.

This soil survey updates the survey of Cheyenne County published in 1920 (3). It gives additional information and has maps that show the soils in greater detail.

General Nature of the County

This section provides general information about Cheyenne County. It briefly describes history and population; transportation; climate; geology; ground

water; physiography, relief, and drainage; and trends in agriculture.

History and Population

In 1867, the Union Pacific Railroad reached the area that is now Cheyenne County. About this time, Fort Sidney was established to protect the tracklaying crews from Indians. In 1870, Cheyenne County was organized and included a large part of the Nebraska panhandle. The discovery of gold in the Black Hills in 1874 brought many travelers through the county on the Sidney-Deadwood Trail. Partly because of this, settlers became aware of the agricultural possibilities of the area. Before 1885, most of the settlers in the county were cattlemen who used the open range. In 1885, large numbers of homesteaders began to settle in the county. Cheyenne County attained its present boundaries in 1909.

In 1870, the population of Cheyenne County was 1,032 and was mostly located in the area of present-day Sidney. By 1910, the population was 4,551. In 1980, it was 10,057. Sidney, the largest town and the county seat, has a population of 6,010. The other incorporated towns in the county are Potter (pop. 369), Lodgepole (pop. 413), Dalton (pop. 345), and Gurley (pop. 212). Sidney is a few miles south of the center of the county and about 350 miles west of Lincoln.

Transportation

Interstate Highway 80 and U.S. Highway 30 cross the county generally from east to west. U.S. Highway 385 enters the county from the east and exits in the north-central part. Nebraska Highway 19 runs southwest from Sidney into Colorado. The towns of Potter, Sidney, and Lodgepole are served by the Union Pacific Railroad, which runs from east to west. Dalton, Gurley, and Sidney are served by the Burlington Northern Railroad, which generally runs from north to south. Sidney also has some bus and airport facilities. Rural roads are generally graveled, but a few are paved.

Climate

In Cheyenne County, winters are cold because of incursions of cold, continental air that bring fairly frequent spells of low temperatures. Summers are hot but occasionally are interrupted by cooler air from the north. Snowfall is fairly frequent in winter, but the snow cover is usually not continuous. Rainfall is heaviest in late spring and early summer. The annual precipitation is normally adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Sidney, Nebraska, in

the period 1951 to 1984. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 degrees F and the average daily minimum temperature is 14 degrees. The lowest temperature on record, which occurred at Sidney on January 19, 1963, is -30 degrees. In summer, the average temperature is 69 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 11, 1954, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 19 inches. Of this, more than 14 inches, or about 75 percent, usually falls in April through September. In 2 years out of 10, the rainfall in April through September is less than 12 inches. The heaviest 1-day rainfall during the period of record was 4.54 inches at Sidney on June 11, 1970. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is more than 41 inches. The greatest snow depth at any one time during the period of record was 27 inches. On the average, 20 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the east-southeast. Average windspeed is highest, 13 miles per hour, in spring.

Severe duststorms occur occasionally in the spring, when strong, dry winds blow across unprotected soils. Tornadoes and severe thunderstorms, some of which are accompanied by hail, occur occasionally. These storms are local in extent and of short duration. The damage is variable and spotty.

Geology

R.F. Diffendal, Jr., research geologist, Conservation and Survey Division, University of Nebraska, helped prepare this section.

The oldest rock unit exposed in Cheyenne County is the upper part of the Brule Formation, which is the youngest formation of the White River Group of the Oligocene epoch (33-29 million years old). Surface

outcrops, road cuts, and railroad cuts through the Brule Formation occur along the sides of valleys along Lodgepole Creek from just east of Sidney westward to the vicinity of Brownson, along the valley sides of Sidney Draw and its tributaries, and along the sides of an unnamed drainageway northwest of Colton. Test drilling and drilling for wells along the floor of Lodgepole Creek have revealed that the alluvial (stream) deposits from the Deuel-Cheyenne County line in the east to the Point of Rocks in the west are also underlain by the Brule Formation.

Much of the Brule Formation is brown to pink siltstone. The silt-sized grains are dominantly made up of volcanic debris erupted from volcanoes that were active in the Rocky Mountains of Colorado, the Great Basin of Nevada and adjoining states, and possibly other areas during the period of Brule deposition. The volcanic debris was transported to Cheyenne County by wind and deposited as an extensive thick blanket of volcanic ash fragments (glass shards and glass mantled crystals). While most of the Brule siltstones are made up of impure volcanic ash, some strata in the Brule Formation are made up of very pure volcanic ash and may be several feet thick.

Some changes occurred in the Brule Formation after its deposition. Clay minerals were deposited in pore spaces between the silt and sand grains. These minerals form cement that bonds the grains together, producing the siltstone. Fractures developed in the Brule siltstones after cementation occurred. The spacing of these fractures varies within the formation and may be related to the weathering of the near-surface layers of the silts during periods when deposition ceased. Calcium carbonate cemented siltstone concretions also formed in some parts of the Brule Formation, probably as a result of changes in included water chemistry or soil-forming processes.

The Ash Hollow Formation of the Ogallala Group is directly above the Brule Formation in the county. This formation is of Miocene age (10.5-5 million years old). It was deposited on the stream eroded surface of the Brule Formation, mainly by rivers draining out of the Rocky Mountains in Wyoming and northern Colorado. The sediments and rocks of the Ash Hollow Formation include sand and gravel, conglomerates, sands, sandstones, silts, siltstones, and diatomites. These kinds of deposits graded laterally and vertically into one another, just as similar deposits of rivers grade into one another today. Streams transported and deposited sediments of the Ash Hollow Formation directly alongside the higher spots where soils were forming on previously deposited sediments. Through time these streams filled their channels with sediments eroded from the granites and other rocks of the Rocky

Mountains and then shifted their positions, cut new channels, and filled these in turn.

In contrast to the tremendous volcanic ash deposits that formed the Brule Formation, the volcanic ash deposits of the Ash Hollow Formation are rarely more than 10 feet thick and generally extend over areas of less than 1 square mile. These ash deposits occur in gullies, swales, ponds, and stream channels that must have been topographically low at the time that the ash was deposited. Ash Hollow ash deposits generally have admixtures of non-volcanic sediments and often appear to have been washed off the surrounding land surfaces into the low spots.

The Ash Hollow Formation is typified by hard calcium carbonate or silica-cemented layers of sandstone or siltstone that form gray ledges that are as much as several feet thick and are separated from one another by softer materials. These so-called "mortar beds" are thought to be remnants of soils formed in the higher areas adjacent to streams during the deposition of the formation. Fossil root structures, "seeds," and other plant fossils in these ledges support this idea.

Material that is younger than that in the Ash Hollow Formation in the county includes unconsolidated windblown silt (loess) and sand covering parts of the uplands on either side of Lodgepole Creek and Sidney Draw, stream deposits (alluvium) beneath valley floors and terraces along the sides of valleys, and slope deposits (colluvium) along the sides of valleys. All of these deposits appear to be relatively young, with most of them less than 20,000 years old.

Strata inclined at angles as much as 9 degrees in the area northwest of Colton and along Rush Creek in the northeastern part of the county indicate that some of the Ash Hollow and older rocks of the county have been deformed by folding or faulting. This deformation may have been responsible for the distribution of ground water and hydrocarbons in some parts of the county.

Ground Water

R.F. Diffendal, Jr., research geologist, Conservation and Survey Division, University of Nebraska, helped prepare this section.

The Brule Formation, which underlies all of Cheyenne County, generally yields only small amounts of water to wells. Large initial yields often followed by rapid declines during pumping may come from wells in fractured parts of the Brule Formation. Wells along the eroded valley sides and on the floors of the valley of Lodgepole Creek and Sidney Draw may be supplied by water from this aquifer.

The Ash Hollow Formation (Ogallala Group) underlies the tablelands and the sides of valleys along Lodgepole Creek and Sidney Draw and also underlies

the valley floor of Lodgepole Creek west of Point of Rocks. Records of test drilling and drilling for irrigation wells indicate that the formation varies from 0 to more than 500 feet in thickness in the county and is thickest in the northern half of the county.

The Ash Hollow Formation is completely saturated below the water table. The saturated thickness where the formation occurs is known to be from less than 35 to more than 290 feet from one part of the county to another. Potential yields to wells vary from little or no yield to more than 1,000 gallons per minute, depending on the thickness of the formation and the kinds of sediments and rocks encountered.

Unconsolidated silts, sands, and pebbles of Quaternary age (younger than 2.8 million years old) are important sources of ground water in the valleys. Municipal supplies for some farms, ranches, villages, and towns along Lodgepole Creek come from these units at least in part.

Municipalities in the county obtain their water from one or more of these three geologic units. Sidney obtains most or all of its water from fractured zones in the Brule Formation. Potter, Gurley, and Dalton obtain water from the Ash Hollow Formation. Lodgepole's water supply comes from Quaternary alluvium.

New wells drilled for irrigation and municipal and industrial supplies are recorded annually. In 1983 the cumulative total of registered irrigation wells in the county was 444, of which 222 used center-pivot systems for water distribution. Most of these wells are in the northern half of the county and along Lodgepole and Cottonwood Creeks and along Sidney Draw. A cumulative total of 31 municipal wells and 13 industrial wells had been drilled in Cheyenne County through 1983.

The supply of ground water is adequate for the needs of most domestic and livestock users in the county. Reliable supplies are most difficult to obtain from areas where the Brule Formation is near the surface. The depth to water varies greatly across the county. The water table occurs at less than 10 feet beneath the surface in areas on the floor of Lodgepole Creek, while it is more than 300 feet beneath the surface of the tablelands at many places.

Water quality throughout the county is generally good. The water ranges from hard to very hard but otherwise is low in mineralization.

Contamination of water supplies is a potential problem. Chemicals introduced during agricultural activities, human and animal wastes that have been improperly disposed, leaking fuel storage tanks, and commercial and household chemicals that have been carelessly discarded are possible sources of

contamination. Water supplies should be checked periodically to determine if a problem is developing, particularly in areas where the sources just mentioned are present.

Physiography, Relief, and Drainage

Cheyenne County is in the High Plains region of the Great Plains. Essentially the county has higher areas to the north and south separated by Lodgepole Creek, which flows from west to east. Other drainageways in the county include Cottonwood and Cow Creeks in the south-central to southeastern part of the county; Rush Creek, which drains the northern third of the county from the northwest to the east; various tributaries of the North Platte River and Pumpkin Creek, which greatly dissect parts of the northern rim of the county; and Sidney and Sand Draws, which drain into Lodgepole Creek in the southwestern part of the county.

In the northwestern tip of the county, the north-central rim, and the northeastern tip are areas of gently sloping to very steep, shallow to very deep, and somewhat excessively drained and well drained soils. These areas include a significant proportion of rock outcrop. Associated with these are areas of soils formed in eolian sediments and loess. These areas are very deep, well drained, and are nearly level to gently sloping.

The high table area in the northern part of the county is the Cheyenne Table. It consists of large areas of very deep, well drained, level to strongly sloping soils. In these areas are some small to large areas of depressional, poorly drained soils. This table is dissected by Rush Creek and tributaries of Lodgepole Creek. Along these drainageways are shallow to very deep soils. These areas are well drained and are nearly level to moderately steep. Along the breaks to the Lodgepole Creek valley are shallow and moderately deep; excessively drained, somewhat excessively drained, and well drained; and gently sloping to very steep areas. The breaks area includes many areas of rock outcrop and gravel and sand knobs.

The Lodgepole Creek valley and Sidney and Sand Draws have very deep and somewhat poorly drained to well drained soils on foot slopes, stream terraces, alluvial fans, and bottom land. These areas are generally nearly level to strongly sloping.

The breaks to Sidney and Sand Draws in the southwest corner of the county are made up of shallow to very deep soils and areas of sandstone and siltstone rock outcrop. These areas are somewhat excessively drained and well drained and are gently sloping to very steep. Above these breaks to the west are small areas of shallow to very deep soils on tables. These areas are

well drained and are nearly level to strongly sloping.

A table area of well drained soils is south of Lodgepole Creek above the breaks. These soils are moderately deep to very deep and are nearly level to strongly sloping.

In the southeastern corner of the county along Cottonwood and Cow Creeks are gently sloping to very steep areas. The soils in these areas are shallow and moderately deep to sand and gravel and are excessively drained to well drained.

Throughout the county are small areas of soils on small ridges that are shallow over bedrock. These soils are generally well drained and are on steeper slopes than the soils in surrounding areas.

Lodgepole Creek has cut a channel about 200 feet below the level of the high plain. The elevation of the county ranges from about 3,800 feet near Lodgepole to about 4,400 feet near the western boundary. The average elevation is about 4,100 feet.

Trends in Agriculture

Winter wheat is the main cash crop in Cheyenne County, with 251,000 acres planted in 1984. Other crops grown are corn (18,500 acres), sorghum (6,400 acres), oats (2,600 acres), barley (4,700 acres), dry, edible beans (10,300 acres), sugar beets (170 acres), and hay (17,000 acres).

In 1909, the county had 15,479 acres in wheat, 14,403 acres in corn, 6,750 acres in oats, 688 acres in barley, 3,216 acres in rye, 389 acres in flaxseed, 970 acres in potatoes, and 1 acre in beans. In 1918, the county had 56,965 acres in winter wheat, and the average yield was 15 bushels per acre. In 1984, the average yield was 40.5 bushels per acre. In 1918, corn was grown on 25,354 acres and produced 20 bushels per acre, whereas the yield in 1984 was 112.8 bushels per acre.

About 550,000 acres of the county is used as cropland. Most of this total is either in winter wheat or summer fallow. About 215,000 acres of the county is used as rangeland or for roads, homesites, and other miscellaneous uses.

In January 1985, 444 wells were registered in the county. In 1980, 40,000 acres was irrigated, but by 1984 the acreage had increased to 45,000 acres.

About 740 farms were in the county in 1979, but this number had decreased to an estimated 690 in 1984.

Livestock are an important source of income in the county. In 1970, 25,100 cattle were on feed, but by 1984 their number had increased to 57,000. The number of hogs in the county in 1984 was 19,500. A

total of 3,000 sows were farrowed in that year, with 23,400 pigs saved.

The general trend in the county is toward fewer farms and larger acreages.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. This material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern related to the geology, landforms, relief, climate, and natural vegetation in the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the U.S.

is based mainly on the kind and character of soil properties and the arrangement of horizons in the profile. After the scientists classified and named the soils in the survey area, they compared the soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based on soil properties and on such variables as climate and biological activity. Soil conditions are predictable over long periods, but they are not predictable from year to year. Thus, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area

dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be named and mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest classification system.

Soil Descriptions

1. Alliance-Duroc-Kuma Association

Deep and very deep, well drained, nearly level to gently sloping, loamy soils formed in loess, alluvial sediment, and eolian material; on uplands

This association consists of soils on upland divides and side slopes and in swales. Slopes range from 0 to 6 percent.

This association has a total area of about 202,800 acres, or about 27 percent of the county. It is about 34 percent Alliance soils, 13 percent Duroc soils, 11 percent Kuma soils, and 42 percent minor soils.

Alliance soils are on divides, side slopes, and ridgetops on uplands and formed in silty loess that overlies weakly cemented, fine grained, limy sandstone. They are nearly level to gently sloping. Typically, the

surface layer is grayish brown loam about 6 inches thick. The subsurface layer is grayish brown loam about 3 inches thick. The subsoil is about 20 inches thick. The upper part is brown silty clay loam, and the lower part is pale brown silt loam. The underlying material to a depth of 52 inches is very pale brown, calcareous silt loam. Below this to a depth of 60 inches is very pale brown, weakly cemented, fine grained, limy sandstone bedrock.

Duroc soils are on the slightly concave parts of side slopes near drainageways and in upland swales and formed in alluvial sediment and eolian material. They are nearly level and very gently sloping. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown loam about 13 inches thick. The subsoil is about 36 inches thick. It is grayish brown loam in the upper part; grayish brown, calcareous silt loam in the next part; and brown and dark grayish brown, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous loam.

Kuma soils are on slightly convex or concave slopes on broad upland flats and formed in loess. They are nearly level. Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown and dark brown silty clay loam, the next part is dark grayish brown silt loam, the next part is brown silt loam, and the lowest part is pale brown silt loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is silt loam, and the lower part is very fine sandy loam.

Of minor extent in this association are Altvan, Canyon, Keith, Rosebud, and Sidney soils. Altvan soils are on side slopes and have gravelly sand at a depth of 20 to 40 inches. Canyon soils are on narrow ridgetops and are shallow to weakly cemented, fine grained, limy sandstone bedrock. Keith soils do not have weakly cemented, fine grained, limy sandstone bedrock and are in landscape positions similar to those of the Alliance soils. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and are in landscape positions similar to those of the Alliance soils. Sidney soils have less clay in the subsoil than the



Figure 2.—Stripcropping helps to control soil blowing on the soils in the Alliance-Duroc-Kuma association.

major soils. They are in landscape positions similar to those of the Alliance soils.

Farms in this association are mainly cash-grain enterprises with some livestock grazing. In most areas the soils are used for cultivated crops. A few cultivated areas are irrigated. The main irrigated crops are alfalfa, corn, wheat, and dry, edible beans. The main dryland crops are wheat and millet.

Soil blowing is the main hazard in the less sloping cultivated areas, and water erosion is the main hazard in the more sloping areas. In the areas managed for dryland crops, insufficient rainfall is the main limitation. Stripcropping helps to control soil blowing (fig. 2). A system of conservation tillage, which leaves protective amounts of crop residue on the surface, and the use of

cover crops help to control soil blowing and water erosion and conserve moisture.

2. Kuma-Keith-Duroc Association

Very deep, well drained, nearly level to gently sloping, loamy soils formed in loess, eolian material, and alluvial sediment; on uplands

This association consists of soils on broad upland flats, divides, and side slopes and in swales. Slopes range from 0 to 6 percent.

This association has a total area of about 207,498 acres, or about 27 percent of the county. It is about 34 percent Kuma soils, 29 percent Keith soils, 17 percent Duroc soils, and 20 percent minor soils (fig. 3).

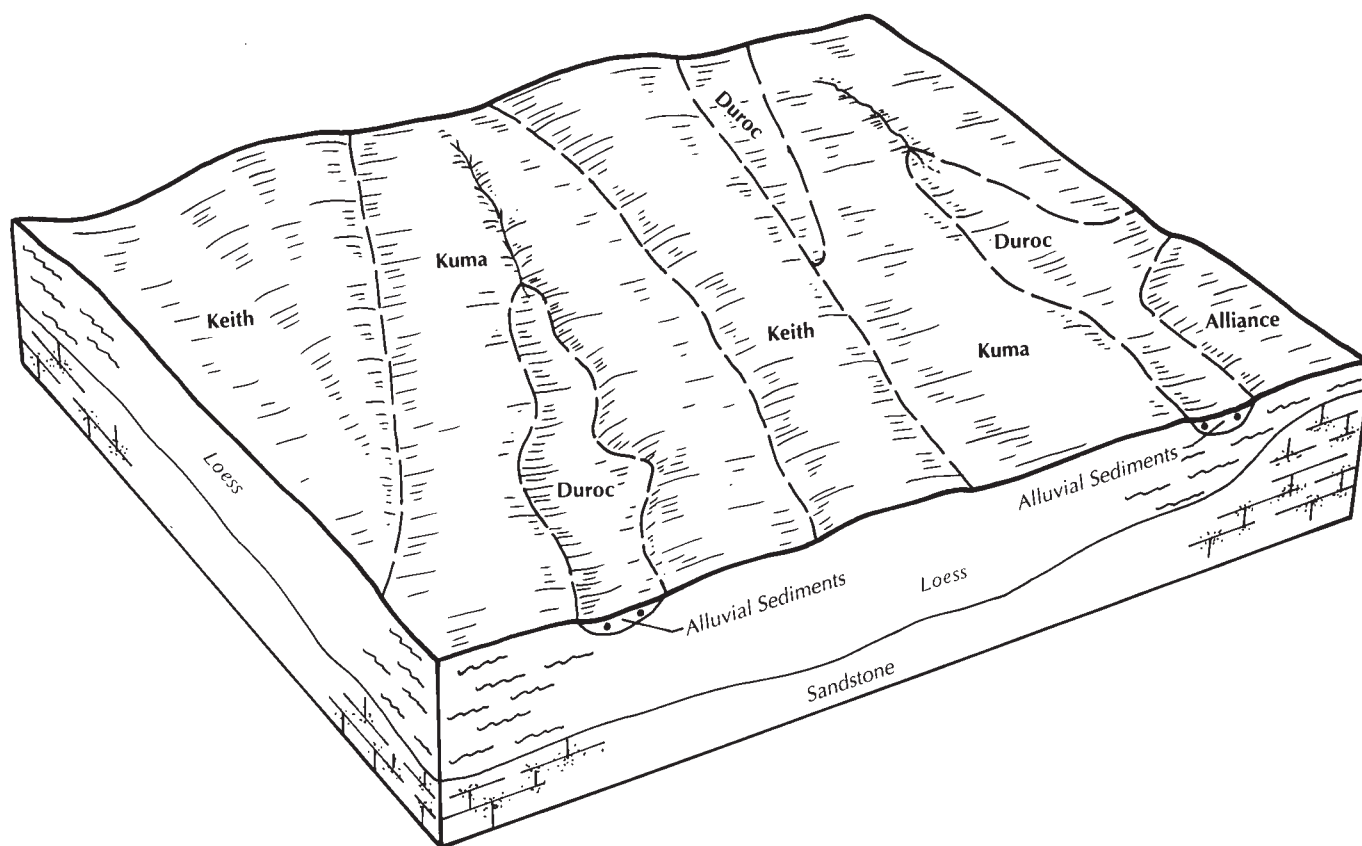


Figure 3.—Typical pattern of soils and parent material in the Kuma-Keith-Duroc association.

Kuma soils are on slightly convex or concave slopes on broad upland flats and formed in loess. They are nearly level. Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown and dark brown silty clay loam, the next part is dark grayish brown silt loam, the next part is brown silt loam, and the lowest part is pale brown silt loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is silt loam, and the lower part is very fine sandy loam.

Keith soils are on slightly convex slopes on broad upland divides, broad summits, and convex side slopes and formed in loess. They are nearly level to gently sloping. Typically, the surface layer is grayish brown loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is about 13 inches thick. The upper part is brown silt loam, and the lower part is pale brown silt loam. The underlying material is calcareous to a depth of 60 inches. The upper part is pale brown silt loam, and the lower part is very pale brown very fine sandy loam.

Duroc soils are on slightly concave parts of side slopes near drainageways and in upland swales and formed in alluvial sediment and eolian material. They are nearly level and very gently sloping. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown loam about 13 inches thick. The subsoil is about 36 inches thick. It is grayish brown loam in the upper part, grayish brown, calcareous silt loam in the next part, and brown and dark grayish brown, calcareous silt loam in the lowest part. The underlying material to a depth of 60 inches is very pale brown, calcareous loam.

Of minor extent in this association are Alliance, Altvan, Rosebud, and Sidney soils. Alliance and Sidney soils are in landscape positions similar to those of the Keith soils and have weakly cemented, fine grained, limy sandstone bedrock within a depth of 60 inches. Altvan soils are on side slopes and have gravelly sand at a depth of 20 to 40 inches. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and are in landscape positions similar to those of the Keith soils.

Farms in this association are mainly cash-grain enterprises. Some areas are used for livestock grazing. In most areas the soils are used for cultivated crops. Some of the cultivated areas are irrigated. Deep wells supply the irrigation water. The main irrigated crops are alfalfa; corn; dry, edible beans; and wheat. The main dryland crops are millet and wheat.

Soil blowing is the main hazard in the less sloping cultivated areas, and water erosion is the main hazard in the more sloping areas. In the areas managed for dryland crops, insufficient rainfall is the main limitation. Stripcropping helps to control soil blowing. A system of conservation tillage, which leaves protective amounts of crop residue on the surface, and the use of cover crops help to control soil blowing and water erosion and conserve moisture.

3. Rosebud-Sidney-Canyon Association

Shallow to deep, well drained, nearly level to strongly sloping, loamy soils formed in calcareous residuum and colluvium; on uplands

This association consists of soils on upland divides, summits, ridgetops, and side slopes. Slopes range from 0 to 9 percent.

This association has a total area of about 36,430 acres, or about 5 percent of the county. It is about 36 percent Rosebud soils, 17 percent Sidney soils, 17 percent Canyon soils, and 30 percent minor soils.

Rosebud soils are on upland divides, summits, ridgetops, and side slopes and formed in loamy calcareous residuum of weakly cemented, fine grained, limy sandstone. They are nearly level to strongly sloping. Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown clay loam, the next part is brown loam, the next part is light brownish gray loam, and the lowest part is light gray loam. Below a depth of 30 inches is white, weakly cemented, fine grained, limy sandstone bedrock to a depth of 60 inches.

Sidney soils are on side slopes in the uplands and formed in loamy colluvium weathered from weakly cemented, fine grained, limy sandstone. They are gently sloping and strongly sloping. Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is light brownish gray loam about 11 inches thick. The underlying material to a depth of 50 inches is loam. The upper part is very pale brown, and the lower part is light gray. Below this to a depth of 60 inches is white, weakly cemented, fine grained, limy sandstone bedrock.

Canyon soils are on narrow ridgetops and convex shoulders of dissected side slopes in the uplands and formed in loamy, calcareous material weathered from

weakly cemented, fine grained, limy sandstone. They are gently sloping and strongly sloping. Typically, the surface layer is grayish brown, calcareous fine sandy loam about 6 inches thick. The underlying material is pale brown, calcareous gravelly loam to a depth of 11 inches. To a depth of 60 inches it is white and light gray, weakly cemented, fine grained, limy sandstone bedrock.

Of minor extent in this association are Alliance, Altvan, Dix, Duroc, and Satanta soils. Alliance soils have more silt and less sand and are in landscape positions similar to those of the Rosebud and Sidney soils. Altvan soils are on side slopes and have gravelly sand at a depth of 20 to 40 inches. Dix soils are on the steeper side slopes and have very gravelly sand within a depth of 20 inches. Duroc soils are in swales and along intermittent drainageways. Satanta soils are in landscape positions similar to those of the Rosebud soils and have gravelly sand at a depth of 40 to 60 inches.

Farms in this association are mainly cash-grain enterprises. Some areas are used for livestock grazing. Most of the soils are used for cultivated crops, especially the soils in nearly level to gently sloping areas. The soils in the more sloping areas and along intermittent drainageways support native grasses and may be used for grazing. Some of the cultivated areas are irrigated. Wells supply the irrigation water. The main irrigated crops are alfalfa; corn; dry, edible beans; and wheat. The main dryland crops are millet and wheat.

Soil blowing is the main hazard in the less sloping cultivated areas, and water erosion is the main hazard in the more sloping areas. In areas managed for dryland crops, insufficient rainfall is the main limitation. Stripcropping helps to control soil blowing. Distributing an adequate supply of irrigation water is a concern in managing irrigated areas. A system of conservation tillage, which leaves protective amounts of crop residue on the surface, and the use of cover crops help to control soil blowing and water erosion and conserve moisture.

4. Altvan-Satanta-Johnstown Association

Moderately deep over gravelly sand and very deep, well drained, nearly level to strongly sloping, loamy soils formed in loess, loamy alluvial sediment, and eolian material deposited over gravelly sand; on uplands and stream terraces

This association consists of soils on broad uplands, ridgetops, side slopes, and stream terraces. Slopes range from 0 to 9 percent.

This association has a total area of about 44,690 acres, or about 6 percent of the county. It is about 27

percent Altvan soils, 24 percent Satanta soils, 12 percent Johnstown soils, and 37 percent minor soils.

Altvan soils are on ridgetops and side slopes in the uplands and stream terraces and formed in loamy sediment that has a component of loess over gravelly sand. They are very gently sloping to strongly sloping. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 19 inches thick. It is brown clay loam in the upper part, pale brown, calcareous clay loam in the next part, and very pale brown, calcareous loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam in the upper part, very pale brown, calcareous gravelly sand in the next part, and pink gravelly sand in the lower part.

Satanta soils are on broad uplands and side slopes in the uplands and on stream terraces and formed in loamy eolian or alluvial sediments over gravelly loamy sand. They are nearly level to gently sloping. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is brown clay loam about 4 inches thick. The subsoil is about 17 inches thick. The upper part is brown clay loam, the next part is pale brown clay loam, and the lower part is very pale brown, calcareous loam. The underlying material is calcareous to a depth of 60 inches. The upper part is very pale brown loam, the next part is very pale brown fine sandy loam, and the lower part is very pale brown gravelly loamy sand.

Johnstown soils are on slightly convex slopes on broad upland flats and formed in loess and loamy sediments. They are nearly level. Typically, the surface layer is grayish brown loam about 5 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is 37 inches thick. The upper part is grayish brown clay loam, the next part is dark grayish brown clay loam, the next part is brown clay loam, the next part is pale brown silt loam, and the lowest part is very pale brown, calcareous silt loam. The underlying material to a depth of 60 inches is pale brown, calcareous gravelly sand.

Of minor extent in this association are Alliance, Dix, Duroc, Keith, and Kuma soils. Alliance and Keith soils are in landscape positions similar to those of the Satanta soils. They contain more silt and less sand than the major soils. Dix soils are on the steeper landscapes and have very gravelly sand within a depth of 20 inches. Duroc soils are in swales and along drainageways and have a dark upper layer that is more than 20 inches thick. Kuma soils are similar to the Johnstown soils and do not have a gravelly sand substratum.

Farms in this association are mainly cash-grain

enterprises. Some areas are used for livestock grazing. In most areas the soils are used for cultivated crops. Some of the cultivated areas are irrigated. Deep wells supply the irrigation water. The main irrigated crops are alfalfa; corn; dry, edible beans; and wheat. The main dryland crops are millet and wheat. The soils in the more sloping areas support native grasses and are used for grazing.

Soil blowing is the main hazard in the less sloping cultivated areas, and water erosion is the main hazard in the more sloping areas. In the areas managed for dryland crops, insufficient rainfall is the main limitation. A system of conservation tillage, which leaves protective amounts of crop residue on the surface, and the use of cover crops help to control soil blowing and water erosion and conserve moisture.

5. Jayem-Duroc-Keith Association

Very deep, well drained, nearly level to gently sloping, loamy soils formed in eolian material, alluvial sediment, and loess; on uplands

This association consists of soils on upland divides, ridgetops, and side slopes and in swales. Slopes range from 0 to 6 percent.

This association has a total area of about 18,130 acres, or more than 2 percent of the county. It is about 45 percent Jayem soils, 16 percent Duroc soils, 9 percent Keith soils, and 30 percent minor soils.

Jayem soils are on convex ridgetops and side slopes in the uplands and formed in eolian material weathered from noncalcareous sandstone. They are very gently sloping and gently sloping. Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 14 inches thick. The subsoil is pale brown fine sandy loam about 11 inches thick. The underlying material is fine sandy loam to a depth of 60 inches. It is pale brown and light yellowish brown in the upper part and very pale brown and calcareous in the lower part.

Duroc soils are on slightly concave parts of side slopes near drainageways and in upland swales and formed in alluvial sediment and eolian material. They are nearly level and very gently sloping. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown loam about 13 inches thick. The subsoil is about 36 inches thick. It is grayish brown loam in the upper part, grayish brown, calcareous silt loam in the next part, and brown and dark grayish brown, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous loam.

Keith soils are on slightly convex slopes on broad upland divides and on convex side slopes. They formed

in loess. They are nearly level to gently sloping. Typically, the surface layer is grayish brown loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is about 13 inches thick. The upper part is brown silt loam, and the lower part is pale brown silt loam. The underlying material is calcareous to a depth of 60 inches. The upper part is pale brown silt loam, and the lower part is very pale brown very fine sandy loam.

Of minor extent in this association are Alliance, Altvan, Creighton, and Kuma soils. Alliance soils are in landscape positions similar to those of the Keith soils and have weakly cemented, fine grained, limy sandstone bedrock within a depth of 60 inches. Altvan soils are on side slopes and have gravelly sand at a depth of 20 to 40 inches. Creighton soils are in landscape positions similar to those of the Jayem soils and have free carbonates above a depth of 40 inches. Kuma soils have a buried soil and are in landscape positions similar to those of the Keith soils.

Farms in this association are mainly cash-grain enterprises. Some areas are used for livestock grazing. In most areas the soils are used for cultivated crops. Very few of the cultivated areas are irrigated. The main irrigated crops are alfalfa; corn; dry, edible beans; and wheat. The main dryland crops are millet and wheat.

Soil blowing is the main hazard in the less sloping cultivated areas, and water erosion is the main hazard in the more sloping areas. In areas managed for dryland crops, insufficient rainfall is the main limitation. Stripcropping helps to control soil blowing. A system of conservation tillage, which leaves protective amounts of crop residue on the surface, and the use of cover crops help to control soil blowing and water erosion and conserve moisture.

6. Canyon-Bayard-Rosebud Association

Shallow, very deep, and moderately deep, well drained, strongly sloping to very steep, loamy soils formed in calcareous residuum and colluvial and alluvial sediments; on uplands and foot slopes

This association consists of soils on breaks, ridgetops, and side slopes in the uplands and on foot slopes. Slopes range from 6 to 60 percent.

This association has a total area of about 76,590 acres, or about 10 percent of the county. It is about 55 percent Canyon soils, 15 percent Bayard soils, 8 percent Rosebud soils, and 22 percent minor soils (fig. 4).

Canyon soils are on narrow ridgetops, dissected side slopes, and sharp slope breaks on the uplands and formed in loamy, calcareous material weathered from weakly cemented, fine grained, limy sandstone. They

are strongly sloping to very steep. Typically, the surface layer is grayish brown, calcareous fine sandy loam about 6 inches thick. The underlying material is pale brown, calcareous gravelly loam to a depth of 11 inches. To a depth of 60 inches it is white and light gray, weakly cemented, fine grained, limy sandstone bedrock.

Bayard soils are on foot slopes and formed in colluvial and alluvial sediments weathered from weakly cemented, fine grained, limy sandstone. They are strongly sloping to steep. Typically, the surface layer is grayish brown fine sandy loam about 8 inches thick. The subsurface layer is grayish brown, calcareous fine sandy loam about 4 inches thick. The transitional layer is light brownish gray, calcareous fine sandy loam about 10 inches thick. The underlying material is calcareous fine sandy loam to a depth of 60 inches. The upper part is light brownish gray, and the lower part is pale brown.

Rosebud soils are on ridgetops and side slopes on the uplands and formed in loamy, calcareous material weathered from weakly cemented, fine grained, limy sandstone. They are strongly sloping. Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown clay loam, the next part is brown loam, the next part is light brownish gray loam, and the lowest part is light gray loam. To a depth of 60 inches it is white, weakly cemented, fine grained, limy sandstone bedrock.

Of minor extent in this association are Alliance, Dix, and Sidney soils and areas of Rock outcrop. Alliance soils are in the less sloping areas and have weakly cemented, fine grained, limy sandstone at a depth of 40 to 60 inches. Dix soils are in landscape positions similar to those of the Canyon soils and have very gravelly sand within a depth of 20 inches. Sidney soils are in landscape positions similar to those of the Bayard soils and formed in loamy, calcareous colluvium weathered from weakly cemented, fine grained, limy sandstone bedrock. The areas of Rock outcrop are on narrow ridgetops and on sharp slope breaks and consist of bare sandstone.

The soils in most areas of this association support native grasses and are used as rangeland. Beef cattle is the main livestock enterprise. Some of the strongly sloping areas are cultivated. The main crops are millet and wheat. The steep and very steep slopes and the shallow soil limit the use of most areas to rangeland and wildlife habitat.

Soil blowing, water erosion, and the shallow soil are the main management concerns affecting cultivated areas. The use of these soils as rangeland helps to control soil blowing and water erosion. Maintaining or increasing the productivity of the rangeland is the main

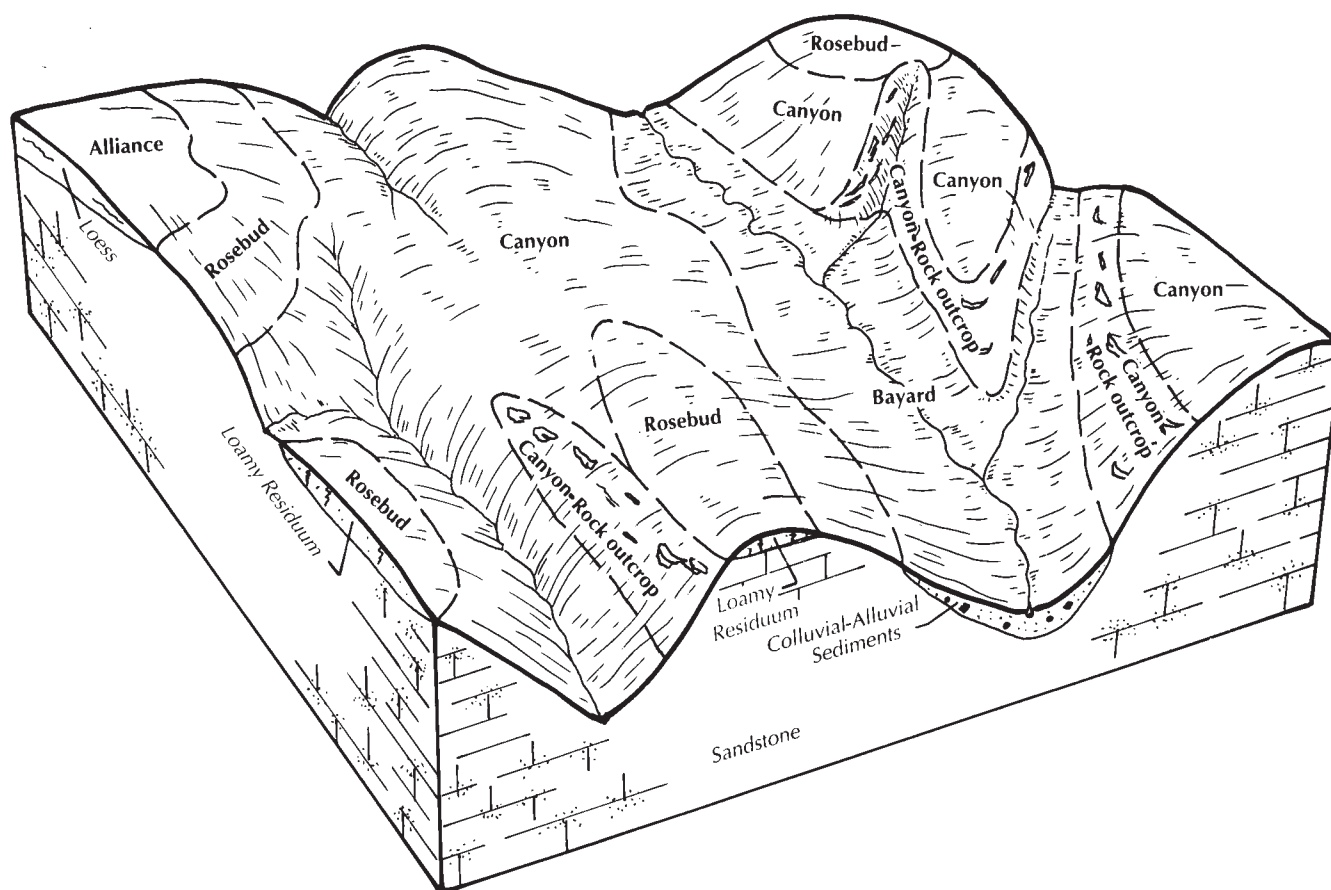


Figure 4.—Typical pattern of soils and parent material in the Canyon-Bayard-Rosebud association.

management concern. Range management that includes proper grazing use and timely deferments from grazing or haying helps to maintain or improve the range condition.

7. Dix-Altvan Association

Shallow and moderately deep over gravelly sand, excessively drained and well drained, very gently sloping to very steep, loamy soils formed in loamy, sandy, and gravelly sediments; on uplands and stream terraces

This association consists of soils on side slopes, ridgetops, and breaks on uplands and stream terraces. Slopes range from 1 to 50 percent.

This association has a total area of about 32,600 acres, or more than 4 percent of the county. It is about 51 percent Dix soils, 20 percent Altvan soils, and 29 percent minor soils (fig. 5).

Dix soils are on narrow ridgetops and convex shoulders of dissected side slopes and formed in loamy, sandy, and gravelly sediments. They are gently sloping

to very steep and are excessively drained. Typically, the surface layer is dark grayish brown gravelly loam 6 inches thick. The transitional layer is brown gravelly sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is brown gravelly loamy coarse sand in the upper part and pale brown very gravelly sand in the lower part.

Altvan soils are on upland ridgetops, side slopes, and breaks of stream terraces and formed in loamy sediment. They are very gently sloping to strongly sloping and are well drained. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 19 inches thick. It is brown clay loam in the upper part; pale brown, calcareous clay loam in the next part; and very pale brown, calcareous loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam in the upper part; very pale brown, calcareous gravelly sand in the next part; and pink gravelly sand in the lower part.

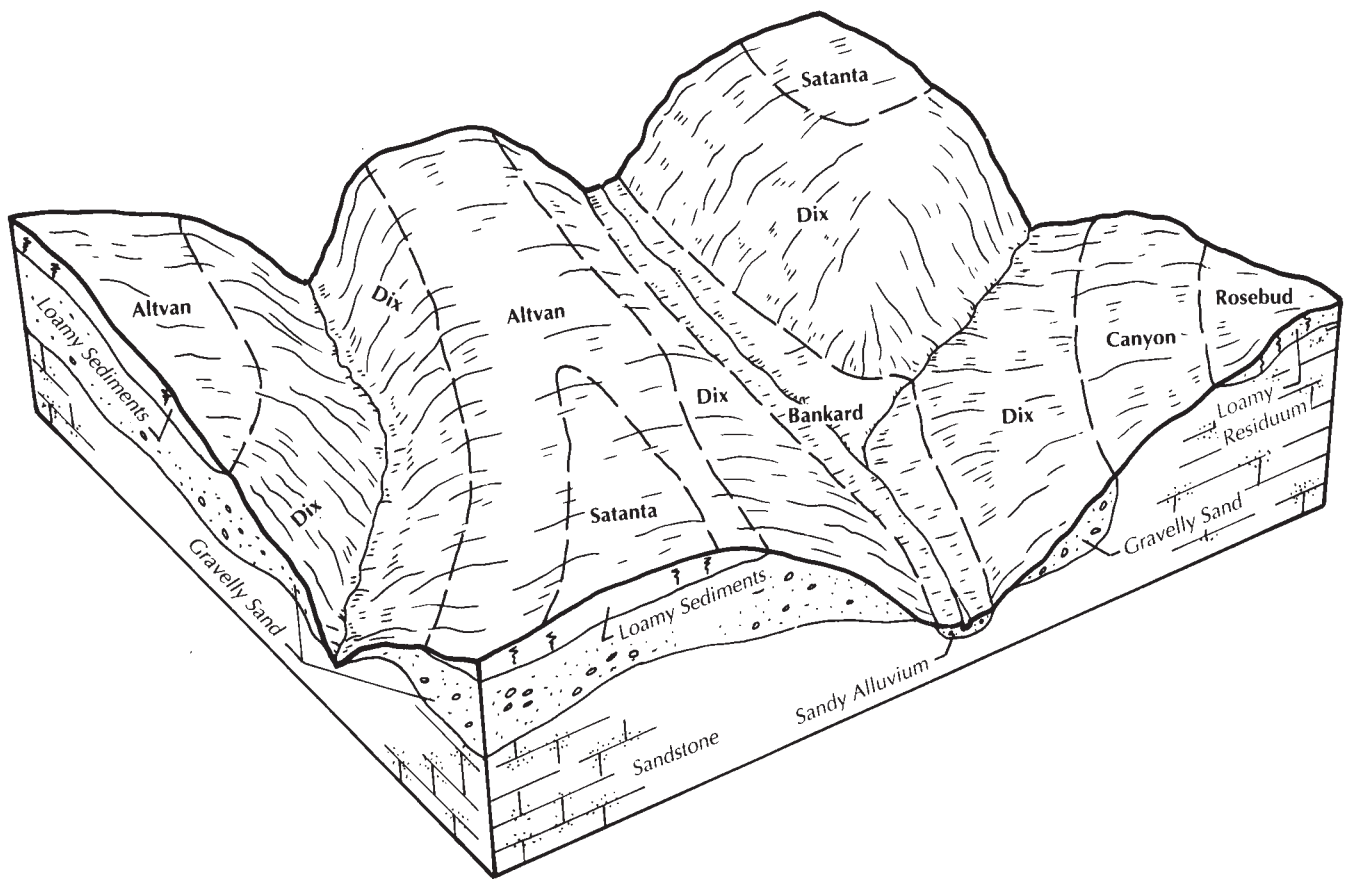


Figure 5.—Typical pattern of soils and parent material in the Dix-Altvan association.

Of minor extent in this association are Bankard, Bayard, Canyon, Rosebud, and Satanta soils. Bankard soils are on flood plains. Bayard soils are on foot slopes and have less clay than the Altvan soils. Canyon soils are in landscape positions similar to those of the Dix soils and are shallow to weakly cemented, fine grained, limy sandstone bedrock. Rosebud soils are in landscape positions similar to those of the Altvan soils and have weakly cemented, fine grained, limy sandstone bedrock at a depth of 20 to 40 inches. Satanta soils are in landscape positions similar to those of the Altvan soils and are deep over gravelly sand.

Farms in this association are diversified, mainly a combination of livestock and cash-grain enterprises. Many of the farms extend into cultivated areas of the adjacent associations. Most of this association supports native grasses and is used as rangeland. Beef cattle is the main livestock enterprise. Some of the very gently sloping to strongly sloping areas are cultivated. The main cultivated crops are millet and wheat. The steep and very steep slopes and the shallow depth to gravelly

sand limit the use of most areas to rangeland and wildlife habitat.

Soil blowing and water erosion are the main hazards in this association. Maintaining or increasing the productivity of the rangeland is the main management concern. Range management that includes proper grazing use and timely deferments from grazing or haying help to maintain or improve the range condition. A system of conservation tillage, cover crops, or using the soils as rangeland help to control soil blowing and water erosion.

8. Mitchell-Epping-Rock Outcrop Association

Areas of Rock outcrop and very deep and shallow, well drained, gently sloping to very steep, loamy soils formed in colluvial and alluvial sediments and material weathered from siltstone; on uplands and foot slopes

This association consists of soils on breaks, ridgetops, and side slopes in the uplands and on foot slopes. Also, it includes strips of Rock outcrop. Slopes

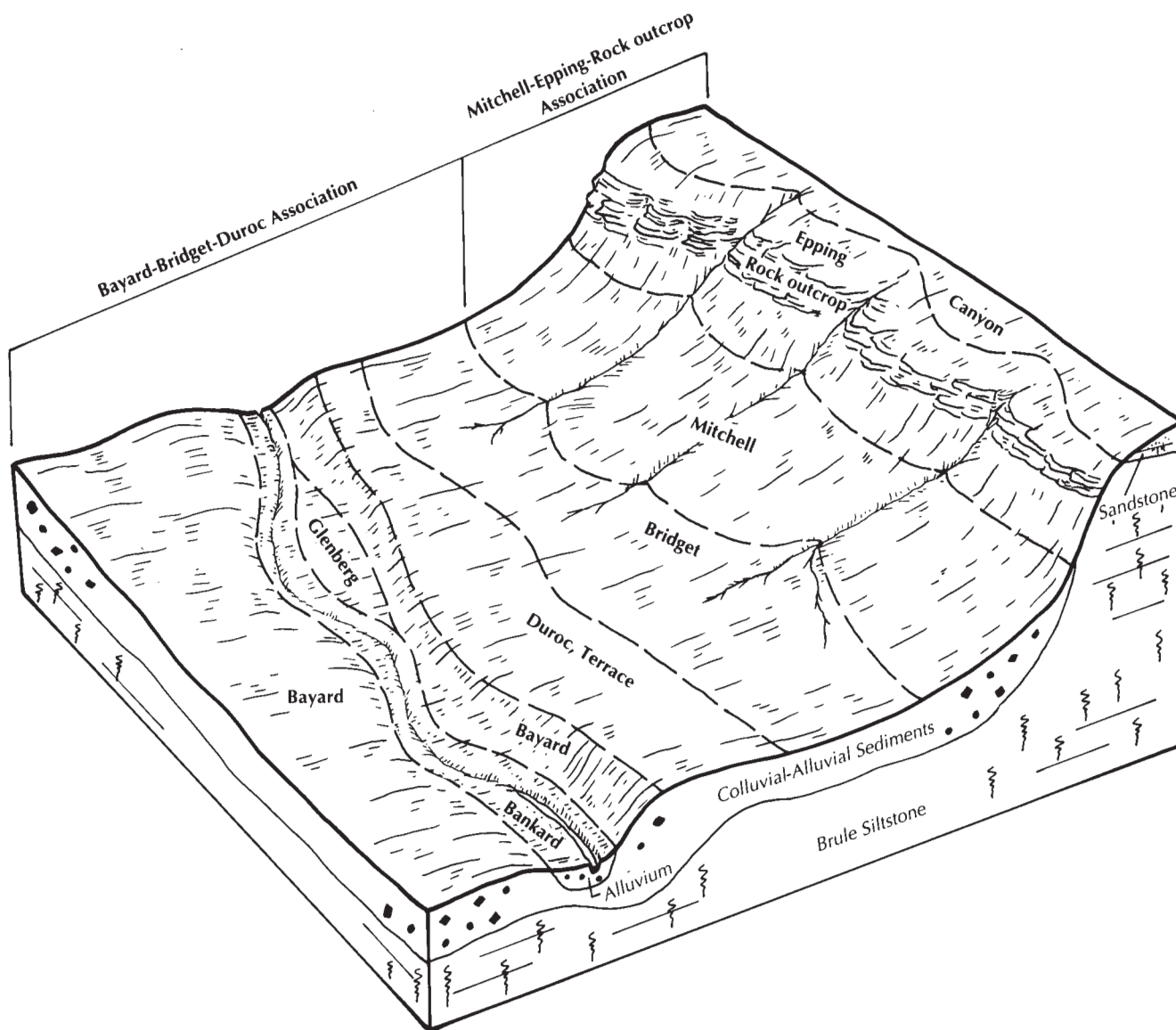


Figure 6.—Typical pattern of soils and parent material in the Mitchell-Epping-Rock outcrop and Bayard-Bridget-Duroc associations.

range from 3 to 60 percent.

This association has a total area of about 6,130 acres, or less than 1 percent of the county. It is about 50 percent Mitchell soils, 25 percent Epping soils, 12 percent Rock outcrop, and 13 percent minor soils (fig. 6).

Mitchell soils are on foot slopes and valley side slopes and formed in colluvial and alluvial sediments weathered from siltstone. They are gently sloping to steep. Typically, the surface layer is light brownish gray, calcareous very fine sandy loam about 5 inches thick. The transitional layer is pale brown, calcareous silt loam

about 12 inches thick. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches.

Epping soils are on narrow ridgetops and side slopes on the upland breaks and formed in loamy material weathered from siltstone. They are gently sloping to very steep. Typically, the surface layer is pale brown, calcareous loam about 5 inches thick. The underlying material is very pale brown, calcareous loam to a depth of 13 inches. To a depth of 60 inches it is very pale brown, calcareous siltstone bedrock.

The areas of Rock outcrop consist of strips of

narrow, very steep areas of bare rock and areas where the soil is very thin over bedrock. The bedrock is mainly siltstone.

Of minor extent in this association are Bridget and Canyon soils. Bridget soils are on the lower foot slopes and have a thicker dark upper layer than the major soils. Canyon soils are on the slightly higher parts of the landscape and are shallow to weakly cemented, fine grained, limy sandstone bedrock.

Most of the soils in this association support native grasses and are used as rangeland (fig. 7). Beef cattle is the main livestock enterprise. The steep and very steep slopes and the shallow soil limit the use of most areas to rangeland and wildlife habitat.

The use of these soils as rangeland helps to control soil blowing and water erosion. Maintaining or increasing the productivity of the rangeland is the main management concern. Range management that includes proper grazing use and timely deferments from grazing or haying helps to maintain or improve the range condition.

9. Alliance-Canyon-Sidney Association

Deep and shallow, well drained, nearly level to steep, loamy soils formed in loess, calcareous residuum, and calcareous colluvium; on uplands

This association consists of soils on divides, ridgetops, and side slopes in the uplands. Slopes range from 0 to 30 percent.

This association has a total area of about 31,610 acres, or more than 4 percent of the county. It is about 26 percent Alliance soils, 22 percent Canyon soils, 11 percent Sidney soils, and 41 percent minor soils.

Alliance soils are on divides, ridgetops, and side slopes in the uplands and formed in silty loess that overlies weakly cemented, fine grained, limy sandstone. They are nearly level to gently sloping. Typically, the surface layer is grayish brown loam about 6 inches thick. The subsurface layer is grayish brown loam about 3 inches thick. The subsoil is about 20 inches thick. The upper part is brown silty clay loam, and the lower part is pale brown silt loam. The underlying material to a depth of 52 inches is very pale brown, calcareous silt loam. To a depth of 60 inches it is very pale brown, weakly cemented, fine grained, limy sandstone bedrock.

Canyon soils are on narrow ridgetops and dissected side slopes in the uplands and formed in loamy, calcareous material weathered from weakly cemented, fine grained, limy sandstone. They are gently sloping to steep. Typically, the surface layer is grayish brown, calcareous fine sandy loam about 6 inches thick. The underlying material is pale brown, calcareous gravelly loam to a depth of 11 inches. To a depth of 60 inches it

is white and light gray, weakly cemented, fine grained, limy sandstone bedrock.

Sidney soils are on side slopes in the uplands and formed in loamy, calcareous colluvium weathered from weakly cemented, fine grained, limy sandstone. They are gently sloping and strongly sloping. Typically, the surface layer is grayish brown, calcareous loam about 7 inches thick. The subsoil is light brownish gray, calcareous loam about 11 inches thick. The underlying material to a depth of 50 inches is calcareous loam. The upper part is very pale brown, and the lower part is light gray. To a depth of 60 inches it is white, weakly cemented, fine grained, limy sandstone bedrock.

Of minor extent in this association are Bankard, Bayard, Dix, Duroc, and Rosebud soils. Bankard soils are on flood plains. Bayard soils are on foot slopes and do not have sandstone bedrock within a depth of 60 inches. Dix soils are in landscape positions similar to those of the Canyon soils and have very gravelly sand within a depth of 20 inches. Duroc soils are in upland swales and have a dark upper layer that is more than 20 inches thick. Rosebud soils are in landscape positions similar to those of the Alliance and Sidney soils and have sandstone bedrock at a depth of 20 to 40 inches.

Farms in this association are mainly a combination of cash-grain and livestock enterprises. The nearly level to strongly sloping soils on divides, ridgetops, and side slopes are used for cultivated crops. The soils on the steeper side slopes and narrow ridgetops support native grasses and are used as rangeland. Topography is the main limitation affecting irrigation, but the water supply may also be a limitation. The main dryland crops are millet and wheat.

Soil blowing and water erosion are the main hazards in cultivated areas. In areas managed for dryland crops, insufficient rainfall is the main limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Range management that includes proper grazing use and timely deferments from grazing or haying helps to maintain or improve the range condition.

10. Busher-Tassel Association

Deep and shallow, well drained, gently sloping to very steep, loamy and sandy soils formed in material weathered from fine grained sandstone; on uplands

This association consists of soils on ridgetops and side slopes in the uplands. Slopes range from 3 to 60 percent.

This association has a total area of about 17,930 acres, or more than 2 percent of the county. It is about

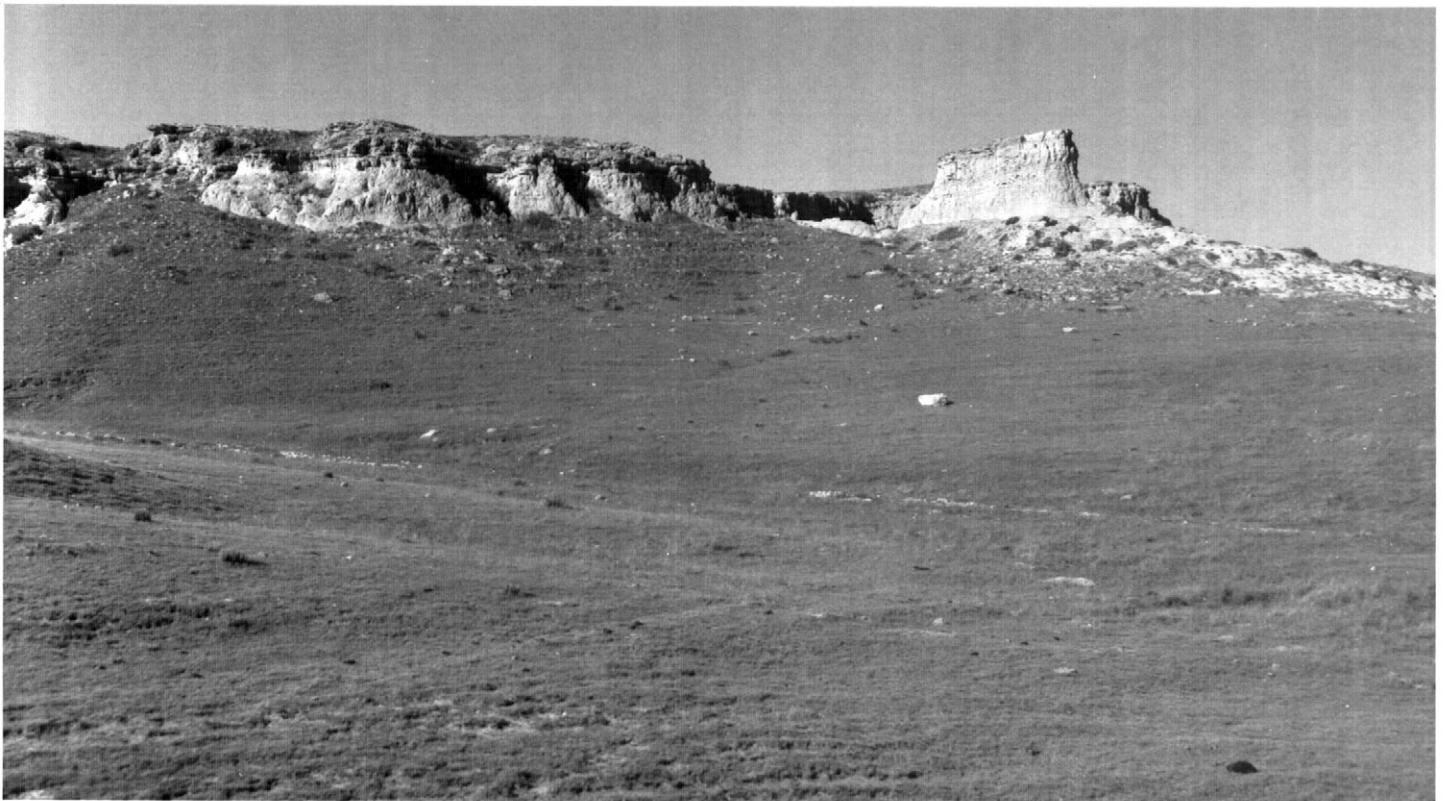


Figure 7.—An area of the Mitchell-Epping-Rock outcrop association used mainly as rangeland.

41 percent Busher soils, 32 percent Tassel soils, and 27 percent minor soils.

Busher soils are on convex ridgetops and side slopes on the uplands and formed in material weathered from weakly cemented, fine grained sandstone. They are gently sloping to moderately steep. Typically, the surface layer is grayish brown fine sandy loam about 6 inches thick. The subsurface layer is fine sandy loam about 13 inches thick. The upper part is grayish brown, and the lower part is brown. The subsoil is brown, calcareous fine sandy loam about 12 inches thick. The underlying material to a depth of 45 inches is very pale brown and calcareous. The upper part is fine sandy loam, and the lower part is loamy very fine sand. To a depth of 60 inches it is weakly cemented, fine grained sandstone bedrock.

Tassel soils are on narrow ridgetops and the upper parts of side slopes on the uplands and formed in calcareous material weathered from weakly cemented, fine grained sandstone. They are gently sloping to very steep. Typically, the surface layer is dark grayish brown loamy very fine sand about 3 inches thick. The subsurface layer is brown, calcareous, loamy very fine sand about 3 inches thick. The underlying material is

pale brown, calcareous, loamy very fine sand. Weakly cemented, fine grained sandstone bedrock is at a depth of about 13 inches.

Of minor extent in this association are Bankard, Canyon, Dix, and Jayem soils and areas of Rock outcrop. Bankard soils are on flood plains. Canyon soils are in landscape positions similar to those of the Tassel soils and have more clay in the soil than the major soils. Dix soils are in landscape positions similar to those of the Tassel soils and have very gravelly sand within a depth of 20 inches. Jayem soils are in the less sloping areas in the uplands. Areas of Rock outcrop are in landscape positions similar to those of the Tassel soils and consist of bare sandstone.

Most areas of the soils in this association support native grasses and are used as rangeland. Beef cattle is the main livestock enterprise. A few of the gently sloping and strongly sloping areas are cultivated. The main cultivated crops are millet and wheat. The steep and very steep slopes and the shallow soil limit the use of most areas to rangeland and wildlife habitat.

The use of these soils as rangeland helps to control soil blowing and water erosion. Water erosion, soil blowing, and the shallow soil are the main management

concerns affecting cultivated areas. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion. Maintaining or increasing the productivity of the rangeland is the main management concern. Range management that includes proper grazing use and timely deferments from grazing or haying helps to maintain or improve the range condition.

11. Bayard-Bridget-Duroc Association

Very deep, well drained, nearly level to gently sloping, loamy and silty soils formed in colluvial and alluvial sediment and eolian material; on foot slopes, stream terraces, and alluvial fans

This association consists of soils on foot slopes, stream terraces, and alluvial fans. Slopes range from 0 to 6 percent.

This association has a total area of about 81,430 acres, or about 11 percent of the county. It is about 39 percent Bayard soils, 25 percent Bridget soils, 15 percent Duroc soils, and 21 percent minor soils (fig. 6).

Bayard soils are on foot slopes, alluvial fans, and stream terraces and formed in colluvial and alluvial sediment. They are nearly level to gently sloping. Typically, the surface layer is grayish brown fine sandy loam about 8 inches thick. The subsurface layer is grayish brown, calcareous fine sandy loam about 4 inches thick. The transitional layer is light brownish gray, calcareous fine sandy loam about 10 inches thick. The underlying material is calcareous fine sandy loam to a depth of 60 inches. The upper part is light brownish gray, and the lower part is pale brown.

Bridget soils are on alluvial fans, stream terraces, and foot slopes and formed in colluvial and alluvial sediment. They are nearly level to gently sloping. Typically, the surface layer is grayish brown, calcareous very fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, calcareous very fine sandy loam about 8 inches thick. The transitional layer is light brownish gray, calcareous very fine sandy loam about 6 inches thick. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of 60 inches.

Duroc soils are in swales on stream terraces and formed in alluvial and colluvial sediment and eolian material. They are nearly level. Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown, calcareous silt loam about 2 inches thick. The subsoil is calcareous silt loam about 33 inches thick. The upper part is dark grayish brown, the next part is grayish brown, and the lower part is brown. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam.

Of minor extent in the association are Bankard, Glenberg, Mitchell, and Satanta soils. Bankard and Glenberg soils are on flood plains and are stratified. Mitchell soils are on foot slopes and valley side slopes and have a thinner, dark upper layer than the major soils. Satanta soils are on valley side slopes and have gravelly loamy sand below a depth of 40 inches.

Farms in this association are diversified, mainly a combination of cash-grain and livestock enterprises. Many of the farms extend into the adjacent associations on the breaks into the uplands. Most of the acreage of this association is cultivated, and part of the acreage is irrigated. The main crops are millet and wheat in dryland areas. The main irrigated crops are alfalfa, corn, and forage crops. The forage crops are used for winter feed.

Soil blowing and water erosion are the main hazards in cultivated areas. In the areas managed for dryland crops, insufficient rainfall is the main limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Applying sufficient irrigation water at a rate that permits maximum absorption and minimum runoff is essential. Range management that includes proper grazing use and timely deferment from grazing or haying helps to maintain or improve the range condition.

12. Las-Glenberg-McCook Association

Very deep, somewhat poorly drained and well drained, nearly level, loamy soils formed in calcareous alluvium; on flood plains

This association consists of soils on flood plains. Slopes range from 0 to 2 percent.

This association has a total area of about 9,660 acres, or more than 1 percent of the county. It is about 33 percent Las soils, 29 percent Glenberg soils, 24 percent McCook soils, and 14 percent minor soils.

Las soils are subject to occasional flooding. They formed in calcareous, loamy alluvium. They are nearly level and are somewhat poorly drained. Typically, the surface layer is grayish brown, calcareous loam about 4 inches thick. The subsurface layer is light brownish gray, calcareous clay loam about 7 inches thick. The underlying material to a depth of 60 inches is calcareous and is stratified light brownish gray and light gray loam, clay loam, sandy loam, and sandy clay loam.

Glenberg soils are subject to rare flooding. They formed in stratified, calcareous alluvium derived from mixed sources. They are nearly level and are well drained. Typically, the surface layer is grayish brown, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is stratified

light brownish gray, light gray, and grayish brown, calcareous fine sandy loam, loamy fine sand, very fine sandy loam, and silt loam.

McCook soils are subject to rare flooding. They formed in weakly stratified, calcareous, loamy alluvium. They are nearly level and are well drained. Typically, the surface layer is grayish brown, calcareous very fine sandy loam about 12 inches thick. The transitional layer is light brownish gray, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is calcareous. The upper part is grayish brown very fine sandy loam, the next part is light brownish gray very fine sandy loam, and the lower part is light brownish gray fine sandy loam.

Of minor extent in this association are Bankard and Las Animas soils. Bankard soils are in landscape positions similar to those of the Las soils, are somewhat excessively drained, and have more sand and less silt in the profile than the major soils. Las Animas soils are in landscape positions that are slightly lower than those of the Las soils and are poorly drained.

Farms in this association are diversified, mainly a combination of cash-grain and livestock enterprises. Many of the farms extend into the adjacent associations on foot slopes and breaks into the uplands. Most cultivated areas are irrigated. The main irrigated crops are alfalfa, corn, forage crops, and sugar beets. The main dryland crops are millet and wheat. The forage crops are used for winter feed. Most areas support native grasses and are used as rangeland. A few areas are planted to grasses that are used as pasture or hayland.

The hazard of soil blowing in cultivated areas can be controlled by a system of conservation tillage that leaves a cover of crop residue on the soil most of the time. Flooding also is a hazard. In the areas managed for dryland crops, insufficient rainfall is the main limitation. Applying sufficient irrigation water at a rate that permits maximum absorption and minimum runoff is essential. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alliance loam, 1 to 3 percent slopes, is a phase of the Alliance series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Altvan-Dix complex, 3 to 9 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named.

Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some soil boundaries and soil names on the detailed maps of this county do not fully match those on the maps of adjacent counties published at an earlier date. Differences result from changes and refinements in series concepts, variations in slope groupings, and application of the latest soil classification systems.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ao—Alliance loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad upland divides. It formed in loess that is underlain by weakly cemented, fine grained, limy sandstone. Areas range from 5 to 70 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown, friable silty clay loam; the next part is brown and dark grayish brown, friable silty clay loam; and the lower part is light gray, very friable, calcareous silt loam. The underlying material is very pale brown, calcareous silt loam about 12 inches thick. To a depth of 60 inches it is weathered, very pale brown, weakly cemented, fine grained, limy sandstone bedrock. In some places the

depth to sandstone bedrock is more than 60 inches. In other places the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Altvan, Duroc, Goshen, and Rosebud soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are on side slopes. Duroc soils have less clay in the subsoil than the Alliance soil and a dark surface layer that is more than 20 inches thick. They are in the lower concave areas. Goshen soils have a dark surface layer that is more than 20 inches thick. They are in swales. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Alliance soil and contain more sand and less silt in the profile. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Alliance soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. The use of a winter cover crop reduces soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the rate of water intake. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during

land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. Building up or mounding the site with suitable fill material improves the filtering capacity of the field. This soil is generally suited to dwellings. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units Ilc-1, dryland, and I-4, irrigated; Silty range site; and windbreak suitability group 3.

AoB—Alliance loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on side slopes and upland divides. It formed in loess that is underlain by weakly cemented, fine grained, limy sandstone. Areas range from 5 to 60 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is grayish brown, friable loam about 3 inches thick. The subsoil is friable and about 20 inches thick. It is brown silty clay loam in the upper part and pale brown silt loam in the lower part. The underlying material to a depth of 52 inches is very pale brown, calcareous silt loam. To a depth of 60 inches it is very pale brown, weakly cemented, fine grained, limy sandstone bedrock. In some areas the soil contains more sand. In other areas gravelly sand, instead of sandstone, is at the lowest level. In some places the depth to sandstone bedrock is more than 60 inches. In other places the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Altvan and Rosebud soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are on the steeper side slopes. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Alliance soil and contain more sand and less silt in the profile. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Alliance soil, and available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the rate of water intake. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is

effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates are good. The lack of seasonal rainfall is the main limitation. Water erosion is the principal hazard. A drip irrigation system can be used to provide additional water as needed. Planting on the contour helps to control water erosion. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. Building up or mounding the site with suitable fill material improves the filtering capacity of the soil. This soil is generally suited to dwellings. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units 11e-1, dryland, and 11e-4, irrigated; Silty range site; and windbreak suitability group 3.

AoC—Alliance loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes and ridgetops in the uplands. It formed in loess that is underlain by weakly cemented, fine grained, limy sandstone. Areas range from 5 to 30 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is friable and about 18 inches thick. It is grayish brown silty clay loam in the upper part, brown silt loam in the next part, and pale brown, calcareous silt loam in the lower part. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of about 43 inches. It is very pale brown, weakly cemented, fine grained, limy sandstone bedrock to a depth of 60 inches. In some places the depth to sandstone bedrock is more than 60 inches. In other places the subsoil contains less clay. In some areas the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Altvan and Rosebud soils. The included soils are in landscape positions similar to those of the Alliance soil. Altvan soils have gravelly sand at a depth of 20 to 40

inches. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Alliance soil, and available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If the slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil losses are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates are good. The lack of seasonal rainfall is the main limitation. Water erosion is the principal hazard. A drip irrigation system can be used to provide additional water as needed. Planting the trees on the contour and terracing help to control water erosion. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. Building up or mounding the site with suitable fill material improves the filtering capacity of the soil. This soil is generally suited to dwellings. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; and windbreak suitability group 3.

AtB—Altvan loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil has gravelly sand at a depth of 20 to 40 inches. It is on side slopes and ridgetops in the uplands and on stream terraces. It formed in loamy sediments. Areas range from 5 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsurface layer is dark brown, friable loam about 4 inches thick. The subsoil is friable and about 19 inches thick. It is brown clay loam in the upper part; pale brown, calcareous clay loam in the next part; and very pale brown, calcareous loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam in the upper part; very pale brown, calcareous gravelly sand in the next part; and pink, calcareous gravelly sand in the lower part. In some places the surface layer is fine sandy loam or silt loam. In other places the subsoil contains less clay. In some areas the gravelly sand is thin and underlain by weakly cemented, fine grained, limy sandstone.

Included with this soil in mapping are small areas of Alliance, Johnstown, Rosebud, and Satanta soils. Alliance soils are deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Altvan soil. Johnstown soils have a dark surface layer that is more than 20 inches thick and have a buried horizon. They are on the less sloping landscapes. Rosebud soils are moderately

deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Altvan soil. Satanta soils have gravelly loamy sand below a depth of 40 inches. They are in landscape positions similar to those of the Altvan soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the solum of the Altvan soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas support native grasses and are used for grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate helps to control excessive runoff and erosion. If the slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade. During land leveling, care should be taken not to expose the underlying sand and gravel.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of

the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. Water erosion is a hazard. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. Planting trees on the contour and terracing help to control water erosion. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. This soil generally is suited to dwellings.

The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Mixing the base material for roads with additives, such as hydrated lime, can help to prevent excessive shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-7, irrigated; Silty range site; and windbreak suitability group 6G.

AtC—Altvan loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil has gravelly sand at a depth of 20 to 40 inches. It is on side slopes and ridgetops in the uplands and on stream terraces. It formed in loamy sediments. Areas range from 5 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is friable and about 16 inches thick. The upper part is brown clay loam, the next part is pale brown and brown clay loam, and the lower part is very pale brown, calcareous loam. The underlying material to a depth of 60 inches is calcareous. The upper part is light gray fine sandy loam, and the lower part is reddish yellow, light brown, and gray gravelly sand. In some places the surface layer is fine sandy loam. In other places the subsoil contains less clay. In some areas gravelly sand or

gravel occurs at shallower depths. In a few areas the gravelly sand is thin and underlain by weakly cemented, fine grained, limy sandstone.

Included with this soil in mapping are small areas of Satanta soils, which have gravelly loamy sand below a depth of 40 inches. They are in landscape positions similar to those of the Altvan soil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the solum of the Altvan soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. Some areas support grasses and are used as rangeland. A few small areas are irrigated.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure improve tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion and soil blowing are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If the slopes are uniform, level benches or parallel terraces constructed at a proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If this soil needs to be land leveled, care should be taken not to expose the underlying gravelly sand.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil

blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. This soil generally is suited to dwellings.

The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Mixing the base material for roads with additives, such as hydrated lime, can help to prevent excessive shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IVE-1, dryland, and IVE-7, irrigated; Silty range site; and windbreak suitability group 6G.

AvD—Altvan-Dix complex, 3 to 9 percent slopes.

These very deep, gently sloping and strongly sloping soils are on uplands and stream terraces. The well drained Altvan soil has gravelly coarse sand at a depth of 20 to 40 inches. It formed in loamy sediments on convex ridgetops and side slopes in the uplands and on breaks of stream terraces. The excessively drained Dix soil has gravelly coarse sand at a depth of 10 to 20 inches. It formed in loamy and sandy gravelly sediments on upland ridgetops and stream terraces. Areas range from 10 to 90 acres in size. They are 50 to 70 percent Altvan soil and 20 to 40 percent Dix soil. These two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Altvan soil has a surface layer of grayish brown, friable loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is

grayish brown, friable clay loam; the next part is grayish brown, firm clay loam; the next part is brown, friable loam; and the lowest part is light gray, calcareous loam. The underlying material is light gray to a depth of 60 inches. It is calcareous fine sandy loam in the upper part and gravelly coarse sand in the lower part. In some places the depth to gravelly coarse sand is more than 40 inches. In places the surface layer is fine sandy loam.

Typically, the Dix soil has a surface layer of brown, friable sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown, friable sandy loam about 4 inches thick. The transitional layer is brown, friable sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is yellowish brown loamy coarse sand in the upper part, light yellowish brown loamy sand in the next part, light brown gravelly coarse sand in the next part, and light brown and pinkish gray gravelly loamy coarse sand in the lowest part. In some areas the soil contains more clay. In some places the surface layer is lighter in color and less than 10 inches thick.

Included with these soils in mapping are small areas of Alliance soils and outcrops of gravel. Alliance soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Altvan and Dix soils. The outcrops of gravel are on steep breaks and narrow ridgetops. Included areas make up 10 to 15 percent of the unit.

Permeability in the Altvan soil is moderate in the solum and very rapid in the underlying material. Permeability in the Dix soil is rapid and very rapid. Available water capacity is moderate in the Altvan soil and very low in the Dix soil. Runoff is medium on both soils. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of these soils is used for cultivated crops. Some areas support grasses and are used as rangeland. A few small areas are irrigated.

If used for dryland crops, these soils are poorly suited to winter wheat and millet. Water erosion is a severe hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface and the use of cover crops help to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Returning crop residue helps to maintain tilth and increase the organic matter content of these soils and improve the fertility of the Dix soil.

If irrigated, these soils are poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion and

soil blowing are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing. The efficient use of irrigation water is a management concern because of the slope. The very low available water capacity of the Dix soil needs to be considered in determining the rate of irrigation water to be applied. A sprinkler irrigation system can be used on these soils. A gravity irrigation system is unsuited to areas of the Altvan soil that have slopes of more than 6 percent. It is unsuited to the Dix soil because of the gravelly coarse sand within a depth of 40 inches. In areas that need to be land leveled, care should be taken not to expose the gravelly coarse sand of the Altvan soil.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland. Brush management may be needed to control undesirable woody plants that invade the site.

The Altvan soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat, and the Dix soil generally is unsuited. Onsite investigation is needed to identify the areas that are best suited to windbreaks. The survival and growth rates of adapted species are fair in areas of the Altvan soil. Water erosion is a severe hazard. The lack of seasonal rainfall is the main limitation. Planting trees on the contour and terracing help to control water erosion. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. The sides of shallow excavations can cave in unless they are shored. These soils generally are suited to dwellings.

The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Mixing the base material for roads with additives, such as hydrated lime, can help to prevent excessive shrinking and

swelling. Roads built on these soils need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

These soils are assigned to capability units IVe-1, dryland, and IVe-7, irrigated. The Altvan soil is in the Silty range site, and the Dix soil is in the Shallow to Gravel range site. The Altvan soil is in windbreak suitability group 6G, and the Dix soil is in windbreak suitability group 10.

Bb—Bankard loamy sand, 0 to 2 percent slopes.

This very deep, nearly level, somewhat excessively drained soil is on flood plains. It is occasionally flooded. It formed in stratified sandy, calcareous alluvium. Areas are elongated and range from 5 to more than 100 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loamy sand about 6 inches thick. The underlying material to a depth of 60 inches is stratified brown, grayish brown, and pale brown, calcareous fine sand, loamy very fine sand, loamy sand, and gravelly sand. In some places the underlying material is noncalcareous.

Included with this soil in mapping are small areas of Bayard, Bridget, Dwyer, and Glenberg soils. Bayard and Bridget soils contain more silt and less sand than the Bankard soil. They are not stratified and are higher on the landscape. Dwyer soils are not stratified. They are more uniformly textured than the Bankard soil and are on the steeper, higher, dune-like, adjacent landscapes. Glenberg soils contain more silt and less sand than the Bankard soil. They are in landscape positions similar to those of the Bankard soil. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Bankard soil, and available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil supports grasses and is used for grazing or hay. Some of the areas are cultivated.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Soil blowing is a severe hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface and the use of cover crops help to control soil blowing and conserve moisture. Stripcropping helps to control soil blowing. Returning crop residue to the soil and applying feedlot

manure improve tilth and increase the organic matter content.

If irrigated, this soil is poorly suited to corn and alfalfa. Water can be applied by a sprinkler irrigation system. Soil blowing is a severe hazard. The use of a winter cover crop helps to control soil blowing. A system of conservation tillage, such as disking or chiseling, no-till plant, and till plant, helps keep crop residue on the surface, control soil blowing, and conserve moisture. Returning crop residue and applying manure to the soil improve tilth, organic matter content, and fertility.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 85 percent or more of the total annual forage. Other perennial grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, sedges, and forbs dominate the site. Under these conditions the native plants lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Soil blowing and the scarcity of seasonal rainfall are the main limitations. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Supplemental moisture can be provided by an irrigation system during periods of low rainfall. The weeds and undesirable grasses in the tree rows can be controlled by cultivation with conventional equipment and by timely applications of

the appropriate kind of herbicide.

This soil is not suited to septic tank absorption fields because of the flooding and the poor filtering capacity. This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. This soil is not suited to dwellings or small commercial buildings because of the flooding. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate side ditches, and installing culverts help to prevent the damage to roads caused by flooding.

This soil is assigned to capability units IVE-5, dryland, and IVE-11, irrigated; Sandy Lowland range site; and windbreak suitability group 7.

Bc—Bankard loamy fine sand, channeled. This very deep, very gently sloping, somewhat excessively drained soil is on flood plains that are dissected by intermittent stream channels, which make up about 30 percent of the unit, are sparsely vegetated, and are lower in elevation. This soil is frequently flooded. It formed in stratified sandy, calcareous alluvium. Areas are long and narrow and range from 5 to more than 100 acres in size. Slopes are mainly 0 to 3 percent.

Typically, the surface layer is grayish brown, very friable, calcareous loamy fine sand about 11 inches thick. The underlying material is pale brown, calcareous, stratified loamy sand, coarse sand, gravelly coarse sand, and gravelly sand to a depth of 60 inches. In some places the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Bayard, Bridget, Dwyer, and Glenberg soils. Bayard and Bridget soils contain more silt and less sand than the Bankard soil. They are not stratified and are higher on the landscape. Dwyer soils are not stratified. They are more uniformly textured than the Bankard soil and are on the steeper, higher, dune-like, adjacent landscapes. Glenberg soils contain more silt and less sand than the Bankard soil. They are in landscape positions similar to those of the Bankard soil. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Bankard soil, and available water capacity is low. Runoff is slow. The organic matter content is low.

Nearly all of the acreage of this soil supports native grasses and is used as rangeland.

This soil is unsuited to farming because of the severe hazard of flooding and the droughtiness. The droughtiness is a result of the low available water

capacity. Overcoming the hazard of flooding and the soil limitations by a system of cultivation generally is not practical.

If this soil is used as range, the climax vegetation is dominantly blue grama, needleandthread, prairie sandreed, and sand bluestem. These species make up 65 percent or more of the total annual forage. Sand dropseed, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and prairie sandreed decrease in abundance and are replaced by blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, blue grama, sedges, common pricklypear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to keep sand bluestem and prairie sandreed in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The low available water capacity and droughtiness are limitations. The amount of forage produced depends on the frequency and amount of seasonal rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

This soil generally is not suited to septic tank absorption fields because of the flooding and the poor filtering capacity. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. This soil is not suited to dwellings and small commercial buildings because of the flooding. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate side ditches, and installing culverts help to prevent the damage to roads caused by flooding.

This soil is assigned to capability unit VIw-7, dryland; Shallow to Gravel range site; and windbreak suitability group 10.

Be—Bayard fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on foot slopes, alluvial fans, and stream terraces. It formed in colluvial and alluvial sediments weathered predominantly from the surrounding weakly cemented, fine grained, limy sandstone. Areas range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is very friable, calcareous fine sandy loam about 10 inches thick. The upper part is grayish brown, and the lower part is grayish brown and brown. The transitional layer is pale brown, very friable, calcareous fine sandy loam about 9 inches thick. The underlying material is calcareous fine sandy loam to a depth of 60 inches. The upper part is pale brown and very pale brown, and the lower part is pale brown. In some places carbonates are at or near the surface. In other places the dark surface layer is more than 20 inches thick. In some areas the soil contains more sand. In other areas the subsoil contains more clay and silt.

Included with this soil in mapping are small areas of Bankard, Bridget, and Glenberg soils. Bankard soils have more sand and less silt in the profile than the Bayard soil. They are stratified and are on flood plains. Bridget soils are in landscape positions similar to those of the Bayard soil. They have more silt and less sand in the profile. Glenberg soils are lighter in color than the Bayard soil. They are stratified and are on flood plains. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and available water capacity is moderate. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderately high.

Most of the acreage of this soil is used for dryland cultivated crops. Some of the acreage is used as rangeland. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling and disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth and increase the content of organic matter. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by

gravity or sprinkler irrigation systems. Soil blowing is the main hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling and disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and leaching of nutrients. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive and small blowouts can form. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses in the tree rows that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide. Restricting cultivation to the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, dwellings, and small commercial buildings. The sides of shallow excavations can cave in unless they are shored. A good surface drainage system can minimize the damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units 11e-3, dryland, and 11e-8, irrigated; Sandy range site; and windbreak suitability group 5.

BeB—Bayard fine sandy loam, 1 to 3 percent slopes. This very deep, very gently sloping, well

drained soil is on foot slopes, alluvial fans, and stream terraces. It formed in colluvial and alluvial sediments weathered predominantly from the surrounding weakly cemented, fine grained, limy sandstone. Areas range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is grayish brown, very friable, calcareous fine sandy loam about 2 inches thick. The transitional layer is pale brown, very friable, calcareous fine sandy loam about 12 inches thick. The underlying material is calcareous to a depth of 60 inches. The upper part is pale brown fine sandy loam, and the lower part is light brownish gray and pale brown loamy fine sand. In some places the surface layer is thinner and lighter in color. In other areas the dark surface layer is more than 20 inches thick. In a few areas the subsoil contains more clay and silt. In some places the soil contains more sand. In other places carbonates are at or near the surface.

Included with this soil in mapping are small areas of Bankard, Bridget, and Glenberg soils. Bankard soils have more sand and less silt in the profile than the Bayard soil. They are stratified and are on flood plains. Bridget soils are in landscape positions similar to those of the Bayard soil. They have more silt and less sand in the profile. Glenberg soils are lighter in color than the Bayard soil. They are stratified and are on flood plains. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and available water capacity is moderate. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderately high.

Most of the acreage of this soil is used for dryland cultivated crops. Some of the acreage is used as rangeland. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Contour farming helps to control erosion. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry,

edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture (fig. 8). Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff, water erosion, and leaching of nutrients. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive and small blowouts can form. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses in the tree rows that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide. Restricting cultivation to the tree rows helps to control soil blowing. Planting the trees on the contour and terracing help to control runoff and water erosion.

This soil generally is suited to septic tank absorption fields, dwellings, and small commercial buildings. The sides of shallow excavations can cave in unless they are shored. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland,



Figure 8.—Leaving corn stubble helps to trap snow in winter on Bayard fine sandy loam, 1 to 3 percent slopes, to conserve moisture and control soil blowing.

and Ile-8, irrigated; Sandy range site; and windbreak suitability group 5.

BeC—Bayard fine sandy loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on foot slopes, alluvial fans, and stream terraces. It formed in colluvial and alluvial sediments weathered predominantly from the surrounding weakly cemented, fine grained, limy sandstone. Areas range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is grayish brown, very friable, calcareous fine sandy loam about 4 inches thick. The transitional layer is light brownish gray, very friable, calcareous fine sandy loam about 10 inches thick. The underlying material is calcareous fine sandy loam to a depth of 60 inches. The upper part is light brownish gray, and the lower part is pale brown. In some places the subsoil contains more clay and silt. In some areas the surface layer is thinner and lighter in color. In a few areas carbonates are at or near the surface.

Included with this soil in mapping are small areas of

Bridget and Canyon soils. Bridget soils are in landscape positions similar to those of the Bayard soil. They contain more silt and less sand in the profile. Canyon soils have weakly cemented, fine grained, limy sandstone bedrock at shallow depths. They are in the higher and steeper areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately high.

Most of the acreage of this soil is used for dryland cultivated crops. Some of the acreage is used as rangeland. A few areas are irrigated.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop

residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Terraces and contour farming help to control erosion. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff, water erosion, and leaching of nutrients. Timely application and efficient distribution of water are needed. If a sprinkler irrigation system is used, less land preparation is needed. If a gravity irrigation system is used, extensive land leveling is needed to attain a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive and small blowouts can form. Overgrazing also can result in a severe hazard of water erosion. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. Water erosion is a hazard. Planting trees on the contour and terracing help to control runoff and water erosion. The weeds and undesirable grasses in the tree rows that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide. Restricting cultivation to the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and dwellings. Small commercial buildings should be designed so that they conform to the natural slope of

the land, or the soil can be graded. The sides of shallow excavations can cave in unless they are shored. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVE-3, dryland, and IIIe-8, irrigated; Sandy range site; and windbreak suitability group 5.

BeD—Bayard fine sandy loam, 6 to 9 percent slopes. This very deep, strongly sloping, well drained soil is on foot slopes. It formed in colluvial and alluvial sediments weathered predominantly from the surrounding weakly cemented, fine grained, limy sandstone. Areas range from 5 to 50 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is grayish brown, very friable, calcareous fine sandy loam about 6 inches thick. The transitional layer is light brownish gray, very friable, calcareous fine sandy loam about 11 inches thick. The underlying material is calcareous to a depth of 60 inches. The upper part is light brownish gray fine sandy loam, and the lower part is pale brown loamy fine sand. In some places the subsoil contains more clay and silt. In other places carbonates are at or near the surface. In a few places the soil contains more sand.

Included with this soil in mapping are small areas of Bridget and Canyon soils. Bridget soils are in landscape positions similar to those of the Bayard soil. They contain more silt and less sand in the profile. Canyon soils have weakly cemented, fine grained, limy sandstone bedrock at shallow depths. They are in the higher and steeper areas. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately high.

Most of the acreage of this soil is used as rangeland. Some of the acreage is used for dryland cultivated crops. A few areas are irrigated.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil helps to

maintain tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. Soil blowing and water erosion are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and water erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and use of terraces help to control water erosion and runoff. A gravity irrigation system is unsuited to this soil.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. This soil generally is the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can

provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses in the tree rows that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide. Restricting cultivation to the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and dwellings. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. The sides of shallow excavations can cave in unless they are shored. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the roads by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVE-3, dryland, and IVE-8, irrigated; Sandy range site; and windbreak suitability group 5.

BeE—Bayard fine sandy loam, 9 to 20 percent slopes. This very deep, moderately steep and steep, well drained soil is on foot slopes. It formed in colluvial and alluvial sediments weathered predominantly from the surrounding weakly cemented, fine grained, limy sandstone. Areas range from 10 to 125 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 4 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 6 inches thick. The transitional layer is pale brown, very friable, calcareous fine sandy loam about 10 inches thick. The underlying material is calcareous fine sandy loam to a depth of 60 inches. The upper part is pale brown, and the lower part is very pale brown. In some places the subsoil contains more clay and silt. In other areas the lower parts of the soil profile may contain more sand. In some areas sandstone is below a depth of 40 inches. In some places carbonates are at or near the surface.

Included with this soil in mapping are small areas of Bridget and Canyon soils. Bridget soils have more silt and less sand in the profile than the Bayard soil. They are lower on the landscape. Canyon soils have weakly cemented, fine grained, limy sandstone bedrock at shallow depths. They are higher on the landscape than the Bayard soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low.

Nearly all of the acreage of this soil supports native grasses and is used as rangeland. Very few very small areas are used for cultivated crops.

This soil generally is unsuited to farming because of

the slope and soil blowing. Overcoming soil blowing and the slope by a system of cultivation generally is not practical.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. This soil generally is the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Soil blowing and the scarcity of seasonal rainfall are the main limitations. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. The trees need to be planted in shallow furrows with as little disturbance of the soil as possible to prevent damage to the seedlings by windblown sand. Supplemental moisture can be provided by an irrigation system during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is not suited to sanitary facilities because of the steep slope. A suitable alternative site should be selected, or the less sloping areas may be used where land shaping and installing the absorption field on the contour helps to ensure that the system operates properly. The sides of shallow excavations can

cave in unless they are shored. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Cutting and filling can provide a suitable grade for roads. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the roads by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability unit Vle-3, dryland; Sandy range site; and windbreak suitability group 7.

Bg—Bridget very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on broad foot slopes, alluvial fans, and stream terraces. It formed in loamy, calcareous, colluvial and alluvial sediments. Areas range from 10 to 120 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The transitional layer is pale brown, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is calcareous silt loam. The upper layer is pale brown, the next layer is very pale brown, the next layer is pale brown, and the lower layer is very pale brown. In some places the dark surface layer is more than 20 inches thick. In other places the soil contains more clay and silt. In some areas the surface layer is lighter in color. In other areas fine sandy loam is below a depth of 30 inches.

Included with this soil in mapping are Bankard, Bayard, and Glenberg soils. Bankard soils have more sand and less silt in the profile than the Bridget soil. They are occasionally flooded and frequently flooded and are on flood plains. Bayard soils are in landscape positions similar to those of the Bridget soil. They have more sand and less silt in the profile. Glenberg soils have more sand and less silt in the profile than the Bridget soil. They are stratified and are on flood plains. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for dryland cultivated crops. Some areas are used as rangeland. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that

leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Soil blowing is the main hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling and disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows.

This soil generally is suited to septic tank absorption fields, dwellings, and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Roads built on this soil need to be designed so that the

surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units Ilc-1, dryland, and Ile-6, irrigated; Silty range site; and windbreak suitability group 3.

BgB—Bridget very fine sandy loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on broad foot slopes, alluvial fans, and stream terraces. It formed in loamy, calcareous, colluvial and alluvial sediments. Areas range from 10 to 250 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable, calcareous very fine sandy loam about 8 inches thick. The transitional layer is light brownish gray, very friable, calcareous very fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is very pale brown, calcareous very fine sandy loam. In some places the dark surface layer is more than 20 inches thick. In other places the soil contains more clay and silt. In some areas the dark surface layer is less than 7 inches thick and is lighter in color. In other areas fine sandy loam is below a depth of 30 inches.

Included with this soil in mapping are Bankard and Bayard soils. Bankard soils are occasionally flooded and frequently flooded. They have more sand and less silt in the profile than the Bridget soil and are on flood plains. Bayard soils are in landscape positions similar to those of the Bridget soil. They have more sand and less silt in the profile. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for dryland cultivated crops. Some areas are used for rangeland. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Contour farming helps to control

water erosion. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Water erosion and soil blowing are the principal hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting on the contour helps to control water erosion.

This soil generally is suited to septic tank absorption fields, dwellings, and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the

absorption field generally can overcome this limitation. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units Ile-3, dryland, and Ile-6, irrigated; Silty range site; and windbreak suitability group 3.

BgC—Bridget very fine sandy loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on foot slopes. It formed in loamy, calcareous, colluvial and alluvial sediments. Areas range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable, calcareous very fine sandy loam about 3 inches thick. The transitional layer is pale brown, very friable, calcareous very fine sandy loam about 9 inches thick. The underlying material to a depth of 60 inches is very pale brown and calcareous. It is very fine sandy loam in the upper part and fine sandy loam in the lower part. In some areas the soil has more clay and silt. In some places the dark surface layer is less than 7 inches thick.

Included with this soil in mapping are small areas of Bayard soils, which are in landscape positions similar to those of the Bridget soil and have more sand and less silt in the profile. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Bridget soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used as rangeland. Some areas are used for cultivated crops. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; wheat; dry,

edible beans; and alfalfa. Water can be applied by a sprinkler irrigation system. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve water. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. Water erosion is a hazard. Planting the trees on the contour and terracing help to control water erosion. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows.

This soil generally is suited to septic tank absorption fields and dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Roads built

on this soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIe-3, dryland, and IIIe-6, irrigated; Silty range site; and windbreak suitability group 3.

BgD—Bridget very fine sandy loam, 6 to 9 percent slopes. This very deep, strongly sloping, well drained soil is on foot slopes. It formed in loamy, calcareous, colluvial and alluvial sediments. Areas range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable, calcareous very fine sandy loam about 6 inches thick. The transitional layer is pale brown, very friable, calcareous very fine sandy loam about 3 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous very fine sandy loam in the upper part and very pale brown, calcareous very fine sandy loam in the lower part. In some places the dark surface layer is less than 7 inches thick. In some areas this soil has more clay and silt. In some places fine sand is below a depth of 30 inches.

Included with this soil in mapping are small areas of Bayard soils and scattered sandstone boulders. Bayard soils are in landscape positions similar to those of the Bridget soil. They have more sand and less silt in the profile. The sandstone boulders generally are scattered on the surface of the soil. They fell from rock outcrops at the higher elevations. Included areas make up about 10 percent of the unit.

Permeability is moderate in the Bridget soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil supports grasses and is used for grazing or hay. Some of the areas are cultivated.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Summer fallowing

conserves moisture for use during the following growing season.

If irrigated, this soil is poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. A gravity irrigation system is unsuited to this soil because of the slope. Water erosion and soil blowing are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and conserve moisture. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at a proper grade can help to control erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If this soil needs to be land leveled, care should be taken not to expose the fine sand.

If this soil is used as range or hayland, the climax vegetation is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 50 percent or more of the total annual forage. Buffalograss, needleandthread, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control water erosion. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows.

This soil generally is suited to septic tank absorption fields and dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IVE-3, dryland, and IVE-6, irrigated; Silty range site; and windbreak suitability group 3.

BuC—Busher fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on broad convex ridgetops in the uplands. It formed in material weathered from fine grained sandstone. Areas range from 5 to 70 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 4 inches thick. The subsoil is very friable fine sandy loam about 13 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material is loamy very fine sand. It is very pale brown in the upper part and light gray and calcareous in the lower part. White, fine grained sandstone bedrock is at a depth of about 56 inches. In some places the surface layer is thinner and lighter in color. In other places the dark surface layer is more than 20 inches thick. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Dix, Jayem, and Tassel soils. The excessively drained Dix soils have very gravelly sand at a depth of 10 to 20 inches. They are in the steeper areas. Jayem soils are in landscape positions similar to those of the Busher

soil. They do not have free carbonates within a depth of 40 inches and do not have sandstone within a depth of 60 inches. Tassel soils are shallow and have a calcareous surface layer that is lighter in color than that of the Busher soil. They are in the steeper areas. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Busher soil, and available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately high.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing is a severe hazard and water erosion is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Contour farming helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade. During land leveling, care should be taken not to expose the underlying sandstone.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil

blowing are excessive and small blowouts can form. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Soil blowing and water erosion are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting the trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

Building up or mounding sites for septic tank absorption fields with suitable fill material improves the filtering capacity of the field. The sides of shallow excavations can cave in unless they are shored. This soil is generally suited to dwellings and roads. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded.

This soil is assigned to capability units IIIe-3, dryland, and IIIe-8, irrigated; Sandy range site; and windbreak suitability group 5.

BxD—Busher-Tassel complex, 3 to 9 percent slopes. These gently sloping and strongly sloping, well drained soils are on uplands. The Busher soil is deep, and the Tassel soil is shallow. The Busher soil is on the broader parts of convex ridgetops and on smooth, convex side slopes. The Tassel soil is on narrow ridgetops, sharp slope breaks, and the upper parts of side slopes. These soils formed in material weathered from fine grained sandstone. Areas range from 10 to 140 acres in size. They are 50 to 75 percent Busher soil and 15 to 40 percent Tassel soil. These two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Busher soil has a surface layer of grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer is very friable fine sandy loam about 13 inches thick. The upper part is grayish brown, and the lower part is brown. The subsoil is brown, very friable, calcareous fine sandy loam about 12 inches thick. The underlying material to a depth of 45 inches is very pale brown and calcareous. The upper part is fine sandy loam, and the lower part is loamy very fine sand. To a depth of 60 inches it is calcareous,

weakly cemented, fine grained sandstone bedrock. In some places the surface layer contains more sand and is lighter in color. In other places the carbonates are leached from the profile, and the subsoil contains more clay. In some areas the soil is moderately deep to sandstone bedrock.

Typically, the Tassel soil has a surface layer of light brownish gray, very friable, calcareous fine sandy loam about 5 inches thick. The underlying material is pale brown, calcareous fine sandy loam about 12 inches thick. To a depth of 60 inches it is white, fine grained sandstone bedrock. In some places the surface layer is darker. In other places the depth to sandstone bedrock is less than 6 inches. In some areas the soil contains more clay.

Included with these soils in mapping are small areas of Dix and Duroc soils and outcrops of sandstone. The excessively drained Dix soils have very gravelly sand at a depth of 10 to 20 inches. They are in landscape positions similar to those of the Busher and Tassel soils. Duroc soils have more clay and less sand in the profile than the Busher and Tassel soils. They have a dark surface layer that is more than 20 inches thick and are in upland swales and on side slopes near drainageways. The outcrops of sandstone are on narrow ridgetops and sharp slope breaks. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Busher and Tassel soils. Runoff is medium on both soils. Available water capacity is moderate in the Busher soil and very low in the Tassel soil. The organic matter content is moderately low in the Busher soil and low in the Tassel soil. The root zone is deep in the Busher soil and shallow in the Tassel soil.

Most of the acreage of these soils supports native grasses and is used as rangeland. Some areas are used for farming, and nearly all of the farming is for dryland crops.

If used for dryland crops, these soils are poorly suited to winter wheat and millet. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulching, and the use of cover crops help keep crop residue on the surface and help to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Returning crop residue to these soils improves tilth and maintains the organic matter content.

If irrigated, these soils are poorly suited to such crops as corn; dry, edible beans; and alfalfa. Water can be applied by a sprinkler irrigation system. Soil blowing and water erosion are severe hazards. A winter cover crop helps to control soil blowing. The very low

available water capacity of the shallow Tassel soil needs to be considered when irrigation water is applied. A system of conservation tillage, such as disking or chiseling, no-till plant, and till plant, helps keep crop residue on the surface, control soil blowing and water erosion, and conserve moisture. Returning crop residue to these soils helps to maintain and improve tilth and fertility.

If the Busher soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the Tassel soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, sand bluestem, and threadleaf sedge. These species make up 55 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and sand bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Busher soil and 0.3 animal unit month per acre on the Tassel soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. These soils generally are the first to be overgrazed when they are in a pasture that includes the Sands range site. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If the Busher soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

The Busher soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion and soil

blowing are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting the trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Tassel soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

On the Busher soil, building up or mounding sites for septic tank absorption fields with suitable fill material improves the filtering capacity of the field. The sides of shallow excavations can cave in unless they are shored. The Busher soil is generally suited to dwellings and roads, except in areas where the slope is more than 8 percent. In these areas dwellings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. Cutting and filling can provide a suitable grade for roads.

The Tassel soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. The soft bedrock can be excavated, and in areas of the Tassel soil that have slope of more than 8 percent, cutting and filling are needed to provide a suitable grade for roads.

These soils are assigned to capability unit IVE-3, dryland, and IVE-8, irrigated. The Busher soil is in the Sandy range site, and the Tassel soil is in the Shallow Limy range site. The Busher soil is in windbreak suitability group 5, and the Tassel soil is in windbreak suitability group 10.

ByE—Busher-Tassel complex, 9 to 20 percent slopes. These moderately steep and steep, well drained soils are on uplands. The Busher soil is deep, and the Tassel soil is shallow. The Busher soil is on ridgetops and convex side slopes. The Tassel soil is on narrow ridges, sharp slope breaks, and dissected side slopes. These soils formed in material weathered from fine grained sandstone. Areas range from 10 to 200

acres in size. They are 45 to 70 percent Busher soil and 20 to 45 percent Tassel soil. These two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable fine sandy loam about 9 inches thick. The subsurface layer is brown, very friable fine sandy loam about 7 inches thick. The subsoil is brown, very friable fine sandy loam about 13 inches thick. The underlying material is pale brown, calcareous fine sandy loam about 13 inches thick. To a depth of 60 inches it is light gray, fine grained sandstone bedrock. In some places the carbonates are leached from the profile. In other places the subsoil contains more clay. In some areas the soil is moderately deep to sandstone bedrock.

Typically, the Tassel soil has a surface layer of dark brown, very friable loamy very fine sand about 3 inches thick. The subsurface layer is brown, very friable, calcareous loamy very fine sand about 3 inches thick. The underlying material is pale brown, calcareous loamy very fine sand to a depth of 18 inches. To a depth of 60 inches it is very pale brown, calcareous fine grained sandstone bedrock. In some places the depth to sandstone bedrock is less than 6 inches. In other places the soil contains more clay.

Included with these soils in mapping are small areas of Dix and Duroc soils and outcrops of sandstone bedrock. Dix soils have very gravelly sand within a depth of 20 inches. They are on small knobs at higher elevations. Duroc soils have a dark surface layer that is more than 20 inches thick. They have more clay and less sand in the profile than the Busher and Tassel soils and are in small upland swales. The outcrops of sandstone bedrock are on narrow ridgetops and sharp slope breaks. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Busher and Tassel soils. Runoff is medium on both soils. Available water capacity is moderate in the Busher soil and very low in the Tassel soil. The organic matter content is moderately low in the Busher soil and low in the Tassel soil. The root zone is shallow in the Tassel soil and deep in the Busher soil.

Nearly all of the acreage of these soils supports native grasses and is used as rangeland. A few small areas have scattered trees.

These soils generally are unsuited to farming because of the slope, soil blowing, and water erosion. Overcoming soil blowing, water erosion, and the slope by a system of cultivation generally is not practical.

If the Busher soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These

species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the Tassel soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, sand bluestem, and threadleaf sedge. These species make up 55 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and sand bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Busher soil and 0.3 animal unit month per acre on the Tassel soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. These soils generally are the first to be overgrazed when they are in a pasture that includes the Sands range site. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In some areas brush management may be needed to control the woody plants that invade the site.

If the Busher soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

The Busher soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion and soil blowing are severe hazards. Planting trees on the contour and maintaining strips of sod between the rows help to control soil blowing and water erosion. Trees need to be planted in shallow furrows with as little disturbance of the soil as possible. The lack of seasonal rainfall is the main limitation. An irrigation system can supply water needed during periods of insufficient moisture. The weeds and undesirable grasses in the tree rows that compete with the trees for moisture can

be controlled by cultivation with conventional equipment and timely applications of the appropriate herbicide.

The Tassel soil generally is unsuited to the trees and shrubs grown as windbreaks or to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

On the Busher soil, building up or mounding sites for septic tank absorption fields with suitable fill material improves the filtering capacity of the field. In areas of this soil that have slope of less than 15 percent, land shaping and installing the absorption field on the contour helps to ensure that the system operates properly. On slopes of more than 15 percent, this soil generally is not suitable for sanitary facilities because of the steep slope. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. Cutting and filling can provide a suitable grade for roads.

The Tassel soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. The soft bedrock generally can be easily excavated during the construction of dwellings with basements. Dwellings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. The soft bedrock can be excavated, and cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit VIe-3, dryland. The Busher soil is in the Sandy range site, and the Tassel soil is in the Shallow Limy range site. The Busher soil is in windbreak suitability group 7, and the Tassel soil is in windbreak suitability group 10.

CcF—Canyon fine sandy loam, 6 to 30 percent slopes. This shallow, strongly sloping to steep, well drained soil is on narrow ridgetops and convex shoulders of dissected side slopes in the uplands. It formed in material weathered from weakly cemented, fine grained, limy sandstone. Areas range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 11 inches is pale brown, calcareous gravelly loam. To a depth of 60 inches it is white and light gray, weakly cemented, fine grained, limy sandstone bedrock. In some areas the depth to sandstone bedrock is more than 60 inches. In a few small areas the slope may be less than 6 or more than 30 percent. In some places the soil contains less clay.

Included with this soil in mapping are small areas of

Rosebud and Sidney soils and areas of rock outcrop. Rosebud soils have more clay in the subsoil than the Canyon soil. They are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and are higher on the landscape. Sidney soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. They are on the lower part of side slopes. The areas of rock outcrop are bare exposures of sandstone. They generally are on the steepest parts of the landscape. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Canyon soil, and available water capacity is very low. Runoff is rapid. The organic matter content is low. The root zone is shallow.

Nearly all of the acreage of this soil is used as rangeland. This soil is unsuited to dryland or irrigated farming because of the slope, a shallow root zone, and the hazard of erosion.

If this soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, hairy grama, big bluestem, and threadleaf sedge. These species make up 70 percent or more of the total annual forage. Other grasses and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may be needed to control the woody plants that invade the site.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

This soil generally is not suited to septic tank absorption fields because of the steep slopes and the shallowness to bedrock. A suitable alternative site should be selected. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. Cutting and filling generally can provide a suitable grade for roads. The soft bedrock can be excavated during the construction of roads.

This soil is assigned to capability unit VIs-4, dryland; Shallow Limy range site; and windbreak suitability group 10.

CdG—Canyon-Rock outcrop complex, 11 to 60 percent slopes. This map unit consists of a moderately steep, steep, and very steep, well drained, shallow Canyon soil and areas of Rock outcrop on uplands. The Canyon soil is on 11 to 45 percent slopes, which are the less sloping areas of narrow ridgetops and dissected side slopes. It formed in material weathered from weakly cemented, fine grained, limy sandstone. The areas of Rock outcrop consist of fine grained, limy sandstone. They are on the steeper part of ridgetops and dissected side slopes. Areas range from 10 to more than 400 acres in size. They are 40 to 60 percent Canyon soil and 30 to 50 percent areas of Rock outcrop.

Typically, the Canyon soil has a surface layer of dark grayish brown, very friable, calcareous fine sandy loam about 5 inches thick. The transitional layer is brown, very friable, calcareous fine sandy loam about 5 inches thick. The underlying material is pale brown, calcareous loam to a depth of 14 inches. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In some areas the depth to sandstone bedrock is more than 60 inches. In a few areas the slope may be less than 11 percent. In a few areas the soil contains less clay.

Typically, the areas of Rock outcrop consist of fine grained, limy sandstone. Thin to thick layers of strongly cemented sandstone alternate with layers of weakly cemented sandstone. In some places outcrops of gravel are at similar elevations. In other places outcrops of calcareous siltstone are at slightly lower elevations.

Included with this unit in mapping are small areas of the well drained Bayard, Rosebud, and Sidney soils. Bayard soils do not have sandstone bedrock within a depth of 60 inches. They are on foot slopes. Rosebud soils have more clay in the subsoil than the Canyon soil. They have weakly cemented, fine grained, limy sandstone bedrock at a depth of 20 to 40 inches and are higher on the landscape. Sidney soils have weakly cemented, fine grained, limy sandstone bedrock below a depth of 40 inches. They are on the lower part of side slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Canyon soil, and available water capacity is very low. The organic matter content is low in the Canyon soil. Runoff is rapid in the Canyon soil and very rapid in areas of Rock outcrop. The root zone is shallow in the Canyon soil.

All the acreage of this complex supports native grasses and is used as rangeland (fig. 9). Many areas



Figure 9.—An area of Canyon-Rock outcrop complex, 11 to 60 percent slopes, used as rangeland.

support only sparse vegetation.

The soils in this unit are unsuited to dryland or irrigated farming because of the slope, a shallow root zone, the hazard of erosion, and the high percentage of Rock outcrop.

If the Canyon soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, hairy grama, big bluestem, and threadleaf sedge. These species make up 70 percent or more of the total annual forage. Other grasses and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If

overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site.

The Canyon soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that

enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

This unit generally is not suited to septic tank absorption fields because it is shallow over bedrock and because of the steep and very steep slopes. A suitable alternative site should be selected. Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. Cutting and filling can provide suitable grades for roads. The soft bedrock generally can be excavated during the construction of roads.

This unit is assigned to capability unit VIIc-4, dryland. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10. The Rock outcrop is not assigned interpretive groupings.

CeE—Canyon-Bayard complex, 6 to 20 percent slopes. These strongly sloping to steep, well drained soils are on uplands and foot slopes. The Canyon soil is shallow, and the Bayard soil is very deep. The Canyon soil is on sharp slope breaks and narrow upland ridges. The Bayard soil is on foot slopes. The Canyon soil formed in material weathered from weakly cemented, fine grained, limy sandstone. The Bayard soil formed in colluvial and alluvial sediments weathered predominantly from weakly cemented, fine grained, limy sandstone. Areas range from 5 to more than 500 acres in size. They are 40 to 60 percent Canyon soil and 30 to 50 percent Bayard soil. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Canyon soil has a surface layer of dark grayish brown, very friable, calcareous fine sandy loam about 3 inches thick. The transitional layer is grayish brown, very friable, calcareous fine sandy loam about 3 inches thick. The underlying material is light brownish gray, calcareous gravelly loam to a depth of 11 inches. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. It is very pale brown and light brownish gray. In some places the depth to sandstone bedrock is more than 60 inches.

Typically, the Bayard soil has a surface layer of grayish brown, very friable fine sandy loam about 12 inches thick. The transitional layer is grayish brown, very friable, calcareous fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is calcareous. The upper part is light brownish gray fine sandy loam, the next part is light gray very fine sandy loam, and the lowest part is light gray fine sandy loam. In some places sandstone is within a depth of 60 inches. In other places carbonates are at or near the surface.

Included with these soils in mapping are small areas

of Rosebud and Sidney soils and areas of Rock outcrop. Rosebud soils have more clay in the subsoil than the Canyon and Bayard soils. They have weakly cemented, fine grained, limy sandstone bedrock at a depth of 20 to 40 inches and are higher on the landscape. Sidney soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Bayard soil. The areas of Rock outcrop are on narrow ridgetops and on sharp slope breaks. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Canyon soil and moderately rapid in the Bayard soil. Available water capacity is very low in the Canyon soil and moderate in the Bayard soil. Runoff is medium on both soils. The organic matter content is low in the Canyon soil and moderately low in the Bayard soil. The root zone is shallow in the Canyon soil and deep in the Bayard soil.

Nearly all of the acreage of these soils supports native grasses and is used as rangeland (fig. 10).

These soils generally are unsuited to farming because of the moderately steep and steep slope. Overcoming the slope by a system of cultivation generally is not practical.

If the Canyon soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, hairy grama, big bluestem, and threadleaf sedge. These species make up 70 percent or more of the total annual forage. Other grasses and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the Bayard soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition on the Canyon soil, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution



Figure 10.—Canyon-Bayard complex, 6 to 20 percent slopes, is used mainly as rangeland.

of grazing. In some areas brush management may be needed to control the woody plants that invade the site.

If the range is in excellent condition on the Bayard soil, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If the Bayard soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only

every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

These soils generally are unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

The Canyon soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. In areas of the Bayard soil where the slope is as much as 15 percent, land shaping and installing the distribution lines on the contour help to ensure that the absorption fields function properly. On slopes of more than 15 percent,

the Bayard soil generally is not suited to sanitary facilities. A suitable alternative site should be selected. The sides of shallow excavations in the Bayard soil can cave in unless they are shored. On the Canyon soil, the soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. On both soils, buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. On the Canyon soil, the bedrock needs to be excavated during the construction of roads. On the Bayard soil, a good surface drainage system can minimize the damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. On both soils, cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit VIs-4, dryland. The Canyon soil is in the Shallow Limy range site, and the Bayard soil is in the Sandy range site. These soils are in windbreak suitability group 10.

CtB—Creighton very fine sandy loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. It formed in calcareous eolian material. Areas range from 5 to 70 acres in size.

Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is brown, very friable very fine sandy loam about 5 inches thick. The subsoil is very friable very fine sandy loam about 29 inches thick. The upper part is brown, and the lower part is light yellowish brown and calcareous. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of 60 inches. In some places loamy very fine sand and fine sand is below a depth of 40 inches. In other places the soil is free of carbonates at a depth of more than 20 inches. In some areas a dark surface soil is below a depth of 20 inches. In some areas sandstone is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance and Keith soils. The included soils are in landscape positions similar to those of the Creighton soil. They have more clay and silt than the Creighton soil. Alliance soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are used for irrigated crops. Some

areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control water erosion. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or

by applications of the appropriate herbicide. Water erosion is a hazard. Planting on the contour helps to control water erosion.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. This soil generally is suited to dwellings and roads.

This soil is assigned to capability units IIe-3, dryland, and IIe-6, irrigated; Silty range site; and windbreak suitability group 3.

CtC—Creighton very fine sandy loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. It formed in calcareous eolian material. Areas range from 5 to 60 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsoil is very friable very fine sandy loam about 20 inches thick. The upper part is brown, and the lower part is pale brown and very pale brown and calcareous. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of 60 inches. In some places the soil is free of carbonates at a depth of more than 20 inches. In other places sandstone is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance and Keith soils. The included soils are in landscape positions similar to those of the Creighton soil. They have more clay and silt than the Creighton soil. Alliance soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing.

Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. Water erosion is the main hazard. Erosion can be controlled by planting trees on the contour and terracing. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. This soil generally is suited to dwellings and roads.

This soil is assigned to capability units IIIe-3, dryland, and IIIe-6, irrigated; Silty range site; and windbreak suitability group 3.

DhD—Dix gravelly loam, 3 to 11 percent slopes.

This very deep, gently sloping to moderately steep, excessively drained soil is on narrow ridgetops and convex shoulders of dissected side slopes on uplands and stream terraces. Very gravelly sand is at a depth of 10 to 20 inches. This soil formed in gravelly sediments. Areas range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable gravelly loam about 6 inches thick. The transitional layer is brown, very friable gravelly loam about 5 inches thick. The underlying material to a depth of 60 inches is brown gravelly loamy coarse sand in the upper part and pale brown very gravelly sand in the lower part. In some areas the soil contains more clay. In other areas the slope may be more than 11 percent.

Included with this soil in mapping are small areas of Altvan, Canyon, and Rosebud soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They have more clay in the subsoil than the Dix soil and are in the less sloping areas. Canyon soils are shallow to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Dix soil. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They contain more clay in the subsoil than the Dix soil and are in the less sloping areas. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the solum of the Dix soil and very rapid in the underlying material. Available water capacity is very low. Runoff is medium. The organic matter content is moderately low. The root zone is shallow.

Nearly all of the acreage of this soil is used as rangeland. A few small areas are cultivated. This soil is unsuited to dryland or irrigated farming because of a shallow root zone and the hazard of erosion.

If this soil is used as range, the climax vegetation is dominantly blue grama, little bluestem, needleandthread, and sand bluestem. These species make up 60 percent or more of the total annual forage. Sand dropseed, other perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by blue grama, sand dropseed, needleandthread, and forbs. If overgrazing continues for many years, blue grama, sedges, common pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or

deferment of grazing in 2 out of 3 years helps keep little bluestem in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The very low available water capacity and droughtiness are limitations. The amount of forage produced depends on the frequency and amount of seasonal rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. If trees and shrubs are planted, their survival or growth is severely limited by the shallow root zone. Onsite investigation is needed to identify the areas that are best suited to windbreaks.

The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. The sides of shallow excavations can cave in unless they are shored. The soil generally is suited to dwellings and roads, except in areas where the slope is more than 8 percent. In these areas dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads.

This soil is assigned to capability unit VIs-4, dryland; Shallow to Gravel range site; and windbreak suitability group 10.

DhG—Dix gravelly loam, 11 to 50 percent slopes.

This very deep, moderately steep to very steep, excessively drained soil is on narrow ridgetops and convex shoulders of dissected side slopes on uplands and stream terraces. Gravelly coarse sand is at a depth of 10 to 20 inches. This soil formed in gravelly sediments. Areas range from 5 to more than 500 acres in size.

Typically, the surface layer is dark brown, very friable gravelly loam about 6 inches thick. The transitional layer is brown and dark yellowish brown, very friable gravelly loam about 4 inches thick. The underlying material is gravelly coarse sand to a depth of 60 inches. The upper part is yellowish brown, and the lower part is light yellowish brown. In some areas the soil contains more clay. In other areas an accumulation of carbonates is present in the underlying material. In a few small areas the slope is less than 11 percent.

Included with this soil in mapping are small areas of Altvan, Bankard, Canyon, and Tassel soils. Altvan soils contain more clay in the subsoil than the Dix soil. They have gravelly sand at a depth of 20 to 40 inches and are in the less sloping areas. Bankard soils are calcareous and stratified and are on flood plains.

Canyon and Tassel soils are calcareous and shallow to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Dix soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the solum of the Dix soil and very rapid in the underlying material. Available water capacity is very low. Runoff is medium. The organic matter content is moderately low.

Nearly all of the acreage of this soil is used as rangeland. This soil is unsuited to dryland or irrigated farming because of the steep and very steep slopes and the hazard of erosion.

If this soil is used as range, the climax vegetation is dominantly blue grama, little bluestem, needleandthread, and sand bluestem. These species make up 60 percent or more of the total annual forage. Sand dropseed, other perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by blue grama, sand dropseed, needleandthread, and forbs. If overgrazing continues for many years, blue grama, sedges, common pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps keep little bluestem in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The very low available water capacity and droughtiness are limitations. The amount of forage produced depends on the frequency and amount of seasonal rainfall.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. If trees and shrubs are planted, their survival or growth are severely limited by the very low available water capacity and the moderately steep and steep slopes. The steep and very steep slopes prevent the use of conventional tree planting and tillage equipment.

This soil generally is not suited to septic tank absorption fields because of the steep and very steep slopes. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored.

Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads.

This soil is assigned to capability unit VII_s-4, dryland; Shallow to Gravel range site; and windbreak suitability group 10.

Du—Duroc loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on slightly concave parts of alluvial fans and in upland swales. It formed in alluvial sediment and eolian material. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable loam about 13 inches thick. The subsoil is friable and about 36 inches thick. It is grayish brown loam in the upper part; grayish brown, calcareous silt loam in the next part; and brown and dark grayish brown, calcareous silt loam in the lower part. The underlying material is very pale brown, calcareous loam to a depth of 60 inches. In some areas the soil contains more sand, and in other areas it contains more clay. In places it has buried horizons.

Included with this soil in mapping are small areas of Keith and Lodgepole soils. Keith soils contain more clay in the subsoil than the Duroc soil. They have dark upper layers within a depth of 20 inches and are slightly higher on the landscape. Lodgepole soils contain more clay in the subsoil than the Duroc soil. They are deeper to carbonates and are in depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Duroc soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderate.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil

blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler system is used. Timely application and efficient distribution of water is needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivation with conventional equipment between the tree rows and by hoeing by hand, rototilling, and applying the appropriate herbicide in the row.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units 11c-1, dryland, and 1-6, irrigated; Silty range site; and windbreak suitability group 1.

DuB—Duroc loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on slightly concave parts of alluvial fans and side slopes near drainageways. It formed in alluvial sediment and eolian

material. Areas range from 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable, and about 29 inches thick. The upper part is loam, and the lower part is silt loam. The transitional layer is brown, friable, calcareous silt loam about 9 inches thick. The underlying material is calcareous silt loam to a depth of 60 inches. It is pale brown in the upper part and very pale brown in the lower part. In some areas the soil contains more clay. In other areas the soil contains more sand. In a few small areas the soil has a buried horizon.

Included with this soil in mapping are small areas of Alliance and Keith soils. The included soils are in landscape positions slightly higher than those of the Duroc soil. Alliance soils contain more clay in the subsoil than the Duroc soil. They have dark upper layers within a depth of 20 inches and have weakly cemented, fine grained, limy sandstone bedrock below the underlying material. Keith soils contain more clay in the subsoil than the Duroc soil and have dark upper layers within a depth of 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Duroc soil, and available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderate.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the organic matter content. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the organic matter content. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity or sprinkler irrigation system can be used

on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row helps distribute water evenly, control erosion, and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Planting on the contour helps to control water erosion.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units Ite-1, dryland, and Ite-6, irrigated; Silty range site; and windbreak suitability group 3.

Dv—Duroc loam, terrace, gravelly substratum, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on stream terraces. It formed in 40 to 60 inches of alluvial sediment and eolian material over

gravelly and sandy sediments. Areas range from 40 to about 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 7 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is friable and about 19 inches thick. The upper part is dark grayish brown clay loam, the next part is grayish brown clay loam, and the lower part is grayish brown, calcareous clay loam. The underlying material to a depth of 49 inches is light gray and very pale brown, calcareous loam. To a depth of 60 inches or more it is very pale brown, calcareous gravelly sand. In some places the dark upper layers are less than 20 inches thick. In other places this soil has a darker buried layer in the subsoil. In a few areas this soil does not have gravelly sand in the underlying material.

Included with this soil in mapping are small areas of Altvan and Bayard soils. The included soils are in landscape positions slightly higher than those of the Duroc soil. Altvan soils have more clay in the subsoil than the Duroc soil. They have gravelly sand at a depth of 20 to 40 inches. Bayard soils have less clay and more sand than the Duroc soil. They have dark upper layers within a depth of 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the solum of the Duroc soil and very rapid in the lower part of the underlying material. Available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderate.

Nearly all of the acreage of this soil is used for cultivated crops. Much of the area is irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil

and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The sides of shallow excavations can cave in unless they are shored. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIc-1, dryland, and I-6, irrigated; Silty range site; and windbreak suitability group 3.

Dx—Duroc silt loam, terrace, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on broad, low fans and stream terraces. It formed in alluvial sediment and eolian material. Areas range from 20 to more than 400 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 2 inches thick. The subsoil is friable, calcareous silt loam about 33 inches thick. The upper part is dark grayish brown, the next part is grayish brown, and the lower part is pale brown. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In some areas this soil has a buried horizon. In other areas this soil is calcareous at or near the surface. In some places the dark upper layers are less than 20 inches thick. In other places the subsoil is silty clay loam or clay loam.

Included with this soil in mapping are small areas of Bayard and Glenberg soils. The included soils have less silt and more sand than the Duroc soil. Bayard soils have dark upper layers within a depth of 20 inches and are slightly higher on the landscape. Glenberg soils are stratified and are on flood plains. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Duroc soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderate.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a

gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. Supplemental water for seedlings may be needed during periods of scarce rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivating with conventional equipment between the tree rows and by hoeing by hand, rototilling, and applying the appropriate herbicide in the row.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIc-1, dryland, and I-6, irrigated; Silty range site; and windbreak suitability group 1.

DyE—Dwyer loamy fine sand, 9 to 17 percent slopes. This very deep, moderately steep, excessively drained soil is on dune like formations on the edges of alluvial terraces near the larger drainageways. It formed in eolian sand. Areas range from 4 to 50 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches is calcareous. The upper part is brown loamy fine sand, and the lower part is pale brown fine sand. In some areas the soil is darker.

Included with this soil in mapping are small areas of Bankard, Bayard, Bridget, and Glenberg soils. Bankard and Glenberg soils are stratified and are on flood

plains. Bayard and Bridget soils contain more silt and less sand than the Dwyer soil. They are on terraces and foot slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Dwyer soil. Available water capacity is low. Runoff is slow. The organic matter content is moderately low.

Most of the acreage of this soil is used as rangeland. This soil generally is not suited to dryland or irrigated cultivated crops because of the slope, the sandy texture, and the very severe hazard of erosion.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, prairie sandreed, and needleandthread. These species make up 45 percent or more of the total annual forage. Blue grama, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand lovegrass and little bluestem decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Soil blowing and the scarcity of seasonal rainfall are the main limitations. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. The trees need to be planted in shallow furrows with as little disturbance of the soil as possible to prevent damage to the seedlings from windblown sand. Supplemental moisture can be provided by an irrigation system during periods of scarce rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The soil readily absorbs but does not adequately

filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Cutting and filling can provide a suitable grade for roads.

This soil is assigned to capability unit Vle-5, dryland; Sands range site; and windbreak suitability group 7.

ErE—Epping-Mitchell complex, 3 to 20 percent slopes. These gently sloping to steep, well drained soils are on uplands and foot slopes. The Epping soil is shallow, and the Mitchell soil is very deep. The Epping soil is on sharp slope breaks and narrow ridgetops and formed in loamy material weathered from siltstone containing volcanic ash. The Mitchell soil is on foot slopes and alluvial and valley side slopes and formed in colluvial and alluvial sediments weathered from siltstone. Areas are long and narrow and range from 10 to 100 acres in size. They are 40 to 60 percent Epping soil and 30 to 50 percent Mitchell soil. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Epping soil has a surface layer of pale brown, very friable and friable, calcareous loam about 5 inches thick. The underlying material is very pale brown, calcareous loam to a depth of 13 inches. To a depth of 60 inches it is very pale brown, calcareous siltstone bedrock. In some areas siltstone rock fragments and granitic pebbles are present on the surface.

Typically, the Mitchell soil has a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The subsurface layer is brown, very friable, calcareous very fine sandy loam about 5 inches thick. The transitional layer is very friable, calcareous very fine sandy loam about 10 inches thick. The upper part is pale brown, and the lower part is very pale brown. The underlying material to a depth of 60 inches is calcareous very fine sandy loam. The upper part is very pale brown, and the lower part is pale brown. In some areas the soil contains more clay and less silt in the profile. In other areas calcareous siltstone is within a depth of 60 inches. In some places the soil has a thicker dark surface layer.

Included with these soils in mapping are small areas of Altvan soils and areas of rock outcrop. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They have a thicker, darker surface layer and more clay in the subsoil than the Epping and Mitchell soils. They are slightly lower on the landscape. The areas of rock outcrop consist of siltstone. They are on knobs, the

steeper side slopes, and narrow ridges. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderate in the Epping and Mitchell soils. Available water capacity is very low in the Epping soil and high in the Mitchell soil. Runoff is rapid in both soils. The organic matter content is low in both soils. The root zone is shallow in the Epping soil and deep in the Mitchell soil.

Nearly all of the acreage in this map unit supports native grasses and is used as rangeland (fig. 11). A few incidental acres are used as cropland.

These soils generally are unsuited to farming because of the moderately steep and steep slope, the droughtiness of the shallow Epping soil, and soil blowing. Overcoming soil blowing and the slope by a system of cultivation generally is not practical.

If the Epping soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, western wheatgrass, blue grama, and threadleaf sedge. These species make up 65 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by sideoats grama, blue grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the Mitchell soil is used as range or hayland, the climax vegetation is dominantly little bluestem, sideoats grama, and blue grama. These species make up 40 percent or more of the total annual forage. Buffalograss, needleandthread, western wheatgrass, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by hairy grama, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition on the Epping soil, the suggested stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may be needed to control the woody plants that invade the site.

If the range is in excellent condition on the Mitchell soil, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock



Figure 11.—An area of Epping-Mitchell complex, 3 to 20 percent slopes, used as rangeland.

watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If the Mitchell soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

The Epping soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

The Mitchell soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Only tree and shrub species

that can tolerate a high amount of calcium in the soil should be planted. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control runoff and water erosion. A lack of seasonal rainfall is the main limitation. An irrigation system can provide supplemental moisture needed during periods of scarce rainfall. Cultivation between the rows and careful use of the appropriate herbicide in the row help to control undesirable grasses and weeds.

The Epping soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. The soft bedrock needs to be excavated, and cutting and filling can provide a suitable grade for roads.

In areas of the Mitchell soil that have slope of less than 15 percent, land shaping and installing the absorption field on the contour helps to ensure that the

system operates properly. In areas that have slope of more than 15 percent, the Mitchell soil generally is not suited to sanitary facilities. A suitable alternative site should be selected. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit VIs-4, dryland. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10. The Mitchell soil is in the Limy Upland range site and windbreak suitability group 8.

Gd—Glenberg fine sandy loam, 0 to 2 percent slopes. This very deep, nearly level, well drained soil is on flood plains. It is subject to rare flooding. It formed in stratified, calcareous alluvial sediment derived from mixed sources. Areas are elongated and range from 5 to 120 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is stratified light brownish gray, light gray, and grayish brown, calcareous fine sandy loam, loamy fine sand, very fine sandy loam, and silt loam. In some places the soil has buried horizons in the lower part.

Included with this soil in mapping are small areas of Bankard, Bayard, Bridget, and Dwyer soils. Bankard soils are in landscape positions similar to those of the Glenberg soil. They have more sand and less silt in the profile. Bayard and Bridget soils have a thicker dark surface layer than that of the Glenberg soil. They are not stratified and are higher on the landscape. Also, Bridget soils have more silt in the control section than the Glenberg soil. Dwyer soils are not stratified. They are more uniformly textured than the Glenberg soil and are on the steeper, higher, dune-like formations on bottom land. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Glenberg soil, and available water capacity is moderate. Runoff is slow. The organic matter content is low. The water intake rate is moderately high.

Most of the acreage of this soil is used as rangeland. Some of the acreage is dry-farmed. A few areas are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture.

Returning crop residue to the soil helps to maintain tilth and increase the content of organic matter. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Soil blowing is the main hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increases the organic matter content, and improves the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and leaching of nutrients. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. A tailwater recovery system can be constructed to conserve water.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, prairie sandreed, and needlegrass. These species make up 50 percent or more of the total annual forage. Blue grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, sedges, and forbs dominate the site. Under these conditions the native plants lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. Supplemental water for seedlings may be needed during periods of scarce rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment between the tree rows and by hoeing by hand, rototilling, and applying the appropriate herbicide in the row.

The flooding is a hazard on sites for septic tank absorption fields. The sides of shallow excavations can cave in unless they are shored. Constructing dwellings and buildings on raised, well compacted fill material helps to prevent the damage caused by floodwater. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate side ditches, and installing culverts help to prevent the damage to roads caused by flooding.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated; Sandy Lowland range site; and windbreak suitability group 1L.

Go—Goshen silt loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is in upland swales. It is subject to rare flooding. It formed in silty alluvium derived mainly from soils formed in loess. Areas range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is grayish brown, friable silt loam about 5 inches thick. The subsoil is grayish brown and about 32 inches thick. The upper part is firm silty clay loam, and the lower part is friable, calcareous silt loam. The underlying material is very pale brown, calcareous silt loam to a depth of 60 inches. In some areas the subsoil contains less clay. In other areas bedrock is in the underlying material. In some places the soil profile contains more clay. In a few small areas this soil has buried horizons.

Included with this soil in mapping are small areas of Alliance, Keith, and Sidney soils. The included soils have dark upper layers within a depth of 20 inches and are higher on the landscape than the Goshen soil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Goshen soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small

acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the organic matter content. Adjusting the water application rate to the water intake rate of the soil helps to control ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment between the tree rows and by hoeing by hand, rototilling, and applying the appropriate herbicide in the rows.

The flooding and the moderate permeability are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field generally can overcome the restricted permeability. Constructing

dwellings on raised, well compacted fill material helps to prevent the damage caused by floodwater. Roads built on this soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units Ilc-1, dryland, and I-4, irrigated; Silty range site; and windbreak suitability group 1.

JmB—Jayem fine sandy loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. It formed in eolian material weathered from noncalcareous sandstone. Areas range from 5 to 250 acres in size.

Typically, the surface layer is dark brown, very friable fine sandy loam about 14 inches thick. The subsoil is very friable fine sandy loam about 32 inches thick. The upper part is brown, and the lower part is yellowish brown. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam. In some areas the dark upper layers are more than 20 inches thick. In other areas the soil contains more sand. In some places the soil is calcareous at shallower depths.

Included with this soil in mapping are small areas of Busher, Duroc, and Keith soils. Busher soils have carbonates at shallower depths. They have sandstone bedrock at a depth of 40 to 60 inches and are on the steeper slopes. Duroc soils have more silt and less sand in the profile than the Jayem soil. They have a dark surface layer that is more than 20 inches thick and are in upland swales and along drainageways. Keith soils are in landscape positions similar to those of the Jayem soil. They have less sand and more clay in the subsoil and have carbonates at shallower depths. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Jayem soil, and available water capacity is moderate. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing is a severe hazard and water erosion is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping

helps to control soil blowing. Contour farming helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water is needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In these areas, care should be taken not to expose the underlying fine sandy loam. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive and small blowouts can form. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall and soil blowing are the main limitations. An irrigation system can provide the supplemental moisture needed during periods of scarce rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The sides of shallow

excavations can cave in unless they are shored.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; and windbreak suitability group 5.

JmC—Jayem fine sandy loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on convex ridgetops and side slopes in the uplands. It formed in eolian material weathered from noncalcareous sandstone. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable fine sandy loam about 14 inches thick. The subsoil is pale brown, very friable fine sandy loam about 11 inches thick. The underlying material to a depth of 60 inches is fine sandy loam. It is pale brown and light yellowish brown in the upper part and very pale brown and calcareous in the lower part. In some places the soil is calcareous at a shallower depth. In other places the dark upper layers are more than 20 inches thick. In some small areas the slope is 1 to 3 percent.

Included with this soil in mapping are small areas of Busher and Keith soils. Busher soils have carbonates at shallower depths. They have sandstone at a depth of 40 to 60 inches and are on the steeper slopes. Keith soils are in landscape positions similar to those of the Jayem soil. They contain more clay throughout the profile, especially in the subsoil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Jayem soil, and available water capacity is moderate. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing (fig. 12). Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage,

such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade. During land leveling, care should be taken not to expose the underlying fine sandy loam.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive and small blowouts can form. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion and soil blowing are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting the trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of scarce rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. The sides of shallow excavations can cave in unless they are shored.

This soil is assigned to capability units IVe-3, dryland, and IIIe-8, irrigated; Sandy range site; and windbreak suitability group 5.



Figure 12.—Stripcropping in an area of Jayem fine sandy loam, 3 to 6 percent slopes.

Jo—Johnstown loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on slightly convex slopes on broad upland flats. Gravelly sand is below a depth of 40 inches. This soil formed in loess and loamy sediment. It has a buried soil. Areas range from 25 to 360 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsurface layer is grayish brown, friable loam about 4 inches thick. The subsoil is friable and about 37 inches thick. The upper part is grayish brown clay loam, the next part is dark grayish brown clay loam, the next part is brown clay loam, the next part is pale brown silt loam, and the lowest part is very pale brown, calcareous silt loam. The underlying material to a depth of 60 inches is pale brown, calcareous gravelly sand. In some areas the gravelly sand is at a depth of more than 60 inches. In other areas this soil does not have buried horizons, and the dark layer is less than 20 inches thick.

Included with this soil in mapping are small areas of Altvan and Duroc soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches and are in the more

sloping areas. Duroc soils have less clay in the subsoil than the Johnstown soil. They do not have buried horizons and are in upland swales. Included soils make up about 5 percent of the unit.

Permeability is moderate in the solum of the Johnstown soil and rapid in the underlying material. Available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying

manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The sides of shallow excavations can cave in unless they are shored. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units 11c-1, dryland,

and 1-4, irrigated; Silty range site; and windbreak suitability group 3.

Ke—Keith loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on slightly convex slopes on broad upland divides. It formed in loess. Areas range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is grayish brown, friable loam about 3 inches thick. The subsoil is friable and about 16 inches thick. The upper part is brown silty clay loam, the next part is brown silt loam, and the lower part is pale brown silt loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is silt loam, and the lower part is very fine sandy loam. In some areas the subsoil contains less clay. In other areas the slope is 1 to 3 percent. In some places weakly cemented, fine grained, limy sandstone is at a depth of less than 60 inches.

Included with this soil in mapping are small areas of Duroc and Kuma soils. The included soils have a dark surface layer that is more than 20 inches thick. They are slightly lower on the landscape than the Keith soil. Duroc soils contain less clay in the subsoil than the Keith soil. Kuma soils have a buried soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Keith soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic

matter content, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units 11c-1, dryland, and 1-4, irrigated; Silty range site; and windbreak suitability group 3.

KeB—Keith loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on broad summits of uplands. It formed in loess. Areas range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer

is grayish brown, very friable loam about 4 inches thick. The subsoil is friable and about 13 inches thick. The upper part is brown silt loam, and the lower part is pale brown silt loam. The underlying material is calcareous to a depth of 60 inches. The upper part is pale brown silt loam, and the lower part is very pale brown very fine sandy loam. In some places gravel pebbles occur in the soil profile. In other places weakly cemented, fine grained, limy sandstone is in the lower part of the underlying material. In a few small areas the soil has buried horizons.

Included with this soil in mapping are small areas of Duroc, Rosebud, and Ulysses soils. Duroc soils have dark upper layers that are more than 20 inches thick. They have less clay in the subsoil than the Keith soil and are in the lower areas. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are on small knolls and side slopes. Ulysses soils are in landscape positions similar to those of the Keith soil. They contain less clay in the subsoil and have carbonates nearer to the surface. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Keith soil, and available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a

sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to planting that enhances wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. Water erosion is a hazard. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Planting on the contour helps to control water erosion.

This soil generally is suited to septic tank absorption fields. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units Ile-1, dryland, and Ile-4, irrigated; Silty range site; and windbreak suitability group 3.

KeC—Keith loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on convex side

slopes in the uplands. It formed in loess. Areas range from 5 to 50 acres in size.

Typically, the surface layer is grayish brown, friable loam about 6 inches thick. The subsurface layer is grayish brown, friable loam about 5 inches thick. The subsoil is friable silt loam about 25 inches thick. The upper part is brown, the next part is pale brown, and the lower part is pale brown and calcareous. The underlying material is very pale brown and calcareous to a depth of 60 inches. It is silt loam in the upper part and very fine sandy loam in the lower part. In some places gravel pebbles occur in the profile. In other places weakly cemented, fine grained, limy sandstone is in the lower part of the underlying material.

Included with this soil in mapping are small areas of Rosebud and Ulysses soils. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are on small knolls and side slopes. Ulysses soils are in landscape positions similar to those of the Keith soil. They contain less clay in the subsoil and have carbonates nearer to the surface. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Keith soil, and available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion (fig. 13).

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil.



Figure 13.—Terraces on Keith loam, 3 to 6 percent slopes.

A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil

blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. Water erosion is a hazard. A drip irrigation system can be used to provide additional water as needed. Planting the trees on the contour and terracing help to control water erosion. The weeds and

undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Roads built on this soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; and windbreak suitability group 3.

Ku—Kuma loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on slightly convex or concave slopes on broad upland flats. It formed in loess over a buried soil. Areas range from 10 to more than 640 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown and dark brown, friable silty clay loam; the next part is dark grayish brown, friable silt loam; the next part is brown, very friable silt loam; and the lower part is pale brown, very friable silt loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is silt loam, and the lower part is very fine sandy loam. In some areas this soil does not have buried horizons. In other areas gravelly sand is in the lower part of the underlying material.

Included with this soil in mapping are small areas of Alliance, Duroc, and Keith soils. Alliance and Keith soils have dark upper layers within a depth of 20 inches and do not have buried horizons. Alliance soils are in landscape positions similar to those of the Kuma soil. They have weakly cemented, fine grained, limy sandstone bedrock below a depth of 40 inches. Duroc soils do not have buried horizons. They have less clay in the subsoil than the Kuma soil and are in swales. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Kuma soil, and available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for

cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for

septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units Ilc-1, dryland, and I-4, irrigated; Silty range site; and windbreak suitability group 3.

Lm—Las loam, 0 to 1 percent slopes. This very deep, nearly level, somewhat poorly drained soil is on flood plains. It formed in calcareous, loamy alluvium that is light in color. This soil is occasionally flooded. Areas range from 10 to more than 500 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loam about 4 inches thick. The subsurface layer is light brownish gray, friable, calcareous clay loam about 7 inches thick. The underlying material to a depth of 60 inches is stratified light brownish gray and light gray, calcareous loam, clay loam, sandy loam, and sandy clay loam. In some places the soils are better drained. In other places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Glenberg, Las Animas, and McCook soils. Glenberg soils are in landscape positions similar to those of the Las soil. They contain less clay and more sand. They are well drained. Las Animas soils are poorly drained. They have more sand and less clay than the Las soil and are slightly lower on the landscape. McCook soils contain less clay and more silt than the Las soil. They are well drained and are slightly higher on the landscape. Also included are small areas of soils where the surface layer is strongly affected by alkalinity. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Las soil, and available water capacity is high. Runoff is slow. The apparent seasonal high water table is at a depth of about 2 to 3 feet. The organic matter content is low. The water intake rate is moderately low.

Most of the acreage of this soil supports native vegetation and is used as rangeland or hayland. A few areas are cultivated, and most are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. The flooding is a hazard. Soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. The wetness from the seasonal high water table also is a limitation that can delay planting or tillage in the spring.

A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Flooding is a hazard. Wetness is a limitation, and soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive ponding.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil.

If this soil is used as range or hayland, the climax vegetation is dominantly indiangrass, switchgrass, sedges, and rushes. These species make up 40 percent or more of the total annual forage. Prairie cordgrass, bluegrass, and forbs dominate the rest. If subject to continuous heavy grazing or improperly harvested for hay, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by western wheatgrass, bluegrass, slender wheatgrass, sedges, and rushes. If overgrazing or improper haying methods continue for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.5 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying and restricted use during wet periods helps to maintain or improve the range condition. This soil generally is the first to be overgrazed when it is in a pasture that includes better drained soils. Properly located fences and livestock watering and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is of best quality when the grasses are cut early. After the ground is frozen, livestock can graze without

damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Tree and shrub species that can withstand the occasional wetness survive and grow well. During wet years, cultivation and planting may be delayed until the soil has begun to dry. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by timely cultivation or by application of the approved herbicide.

This soil is not suited to septic tank absorption fields and dwellings because of the flooding and wetness. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Shoring needs to be completed during dry periods. Roads built on this soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to prevent the damage to roads caused by flooding and wetness.

This soil is assigned to capability units IVw-4, dryland, and IIw-6, irrigated; Subirrigated range site; and windbreak suitability group 2S.

Lw—Las Animas loam, 0 to 2 percent slopes. This very deep, nearly level, poorly drained soil is on flood plains. It formed in thick, calcareous, stratified alluvial sediment derived from mixed sources. This soil is frequently flooded. Individual areas are generally long and narrow and are along active and abandoned stream channels. Areas range from 10 to more than 100 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loam about 5 inches thick. The transitional layer is light brownish gray, very friable, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is stratified light gray and light brownish gray, calcareous fine sandy loam, sandy loam, loamy fine sand, and very fine sandy loam. In some places the soil contains more silt and clay and is somewhat poorly drained.

Included with this soil in mapping are small areas of Bankard, Bayard, and Glenberg soils and areas of marsh. Bankard soils contain more sand than the Las Animas soil. They are somewhat excessively drained and are slightly higher on the landscape. Bayard soils are well drained and are on alluvial fans, stream terraces, and foot slopes. Glenberg soils are well drained and are slightly higher on the landscape than

the Las Animas soil. The areas of marsh are ponded for long periods, support such plants as cattails and reeds, and are lower on the landscape than the Las Animas soil. Included areas make up about 10 percent of the unit.

Permeability is moderately rapid in the Las Animas soil, and the available water capacity is low. The runoff is ponded. The seasonal high water table ranges from the surface during wet years to a depth of about 1.5 feet during dry years. The organic matter content is low.

Nearly all areas of this soil support native vegetation. They are used as rangeland or are left idle and used as wildlife habitat.

This soil is not suitable for dry-farmed or irrigated crops because of the seasonal high water table and the frequent flooding.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and sedges. These species make up 65 percent or more of the total annual forage. Bluegrass, slender wheatgrass, green muhly, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, and northern reedgrass decrease in abundance and are replaced by slender wheatgrass, bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying methods continue for many years, bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 2.1 animal unit months per acre. This soil produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. Grazing and heavy machinery traffic when the soil is wet can result in surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. In wet years, hay cannot be harvested in some areas of this soil. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. If trees and shrubs are planted, their survival and growth are severely limited by the seasonal high water table and the flooding. Some areas can support the trees or shrubs used to enhance wildlife habitat if suitable species are planted by hand or if other special management is applied.

This soil is not suited to septic tank absorption fields

and dwellings because of the flooding and wetness. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Shoring needs to be completed during dry periods. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to prevent the damage to roads caused by flooding and wetness. A good surface drainage system and a gravel moisture barrier in the subgrade can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability unit Vw-7, dryland; Wetland range site; and windbreak suitability group 10.

Ly—Lodgepole silt loam, 0 to 1 percent slopes.

This very deep, nearly level, somewhat poorly drained soil is in depressions on the uplands. It formed in loess and loamy sediment. This soil is ponded for short periods. Areas are circular or oval in shape and range from 3 to 150 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is light brownish gray, friable silt loam about 2 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, firm silty clay; the next part is grayish brown, very firm clay; and the lower part is grayish brown, firm silty clay. The underlying material to a depth of 58 inches is brown, calcareous silt loam. To a depth of 60 inches or more it is very pale brown, calcareous sandy loam. In some places weakly cemented, fine grained, limy sandstone is below a depth of 40 inches.

Included with this soil in mapping are small areas of Alliance, Duroc, and Keith soils. Alliance and Keith soils contain less clay in the subsoil than the Lodgepole soil. They have a dark surface layer within a depth of less than 20 inches and are slightly higher on the landscape. Duroc soils contain less clay in the subsoil than the Lodgepole soil. They are on the slightly higher, adjacent landscapes. Included soils make up about 10 percent of the unit.

Permeability is very slow in the Lodgepole soil, and available water capacity is high. The soil is occasionally ponded for short periods from March through June. A perched seasonal high water table fluctuates from about 6 inches above the surface to within a depth of 1 foot below the surface in spring. The organic matter content is moderate. The shrink-swell potential is high in the subsoil.

Most of the acreage of this soil is used for cultivated

crops. Some areas support native grasses and are used for hay and grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Ponding is a severe hazard. Crops are often damaged because runoff from adjacent areas after heavy rains results in ponding. Weed competition is a problem because timely cultivation is difficult. Soil compaction is a problem if the soil is worked when wet. Soil blowing may be a hazard in dry years in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing. Returning crop residue to the soil and applying manure improve tilth and increase the content of organic matter.

This soil is unsuited to irrigation. Because of a slow water intake rate, the soil is easily ponded and cannot be easily managed for irrigated crops.

This soil is suited to range and native hay. Continuous heavy grazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. If trees and shrubs are planted, their survival and growth are severely limited because the soil is somewhat poorly drained and is ponded for short periods. Onsite investigation is needed to identify the areas that are best suited to windbreaks.

This soil is not suited to septic tank absorption fields and dwellings because of the very slow permeability and the ponding. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the level of ponding and providing adequate side ditches and culverts help to prevent the damage to roads caused by ponding and wetness. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. Mixing the base material with additives, such as hydrated lime, can help to prevent excessive shrinking and swelling.

This soil is assigned to capability units Illw-2, dryland, and IVw-2, irrigated; Clayey Overflow range site; and windbreak suitability group 10.

Mc—McCook very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on flood plains. It is subject to rare flooding. It formed in weakly stratified, calcareous, loamy alluvium. Areas

range from 15 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 12 inches thick. The transitional layer is light brownish gray, very friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is calcareous. The upper part is grayish brown very fine sandy loam, the next part is light brownish gray very fine sandy loam, and the lower part is light brownish gray fine sandy loam.

Included with the soil in mapping are areas of Bankard, Bridget, and Las soils. Bankard soils contain more sand than the McCook soil. They are on the lower flood plains. Bridget soils are not stratified and are on the higher stream terraces and foot slopes. Las soils are somewhat poorly drained. They have more clay at a depth of 10 to 40 inches and are lower on the landscape than the McCook soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the McCook soil, and available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. Some areas are irrigated. A few areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Soil blowing is the main hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling and disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling

is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range and native hay. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. Supplemental water for seedlings may be needed during periods of scarce rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment between the tree rows and by hoeing by hand, rototilling, and applying the appropriate herbicide in the row.

The flooding and the moderate permeability are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field generally can overcome the restricted permeability. Constructing dwellings and buildings on raised, well compacted fill material help to prevent the damage caused by floodwater. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate side ditches, and installing culverts help to prevent the damage to roads caused by flooding. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the roads by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units 11c-1, dryland, and 11e-5, irrigated; Silty Lowland range site; and windbreak suitability group 1L.

MkC—Mitchell very fine sandy loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on foot slopes and valley side slopes. It formed in colluvial and alluvial sediments weathered from siltstone. Areas range from 10 to more than 200 acres in size.

Typically, the surface layer is very friable, calcareous very fine sandy loam about 11 inches thick. The upper part is grayish brown, and the lower part is pale brown. The transitional layer is pale brown, very friable, calcareous very fine sandy loam about 12 inches thick. The underlying material is calcareous to a depth of 60

inches. It is pale brown very fine sandy loam in the upper part and very pale brown silt loam in the lower part. A buried layer of pale brown, calcareous silt loam is at a depth of 35 to 39 inches. In some places siltstone occurs within a depth of 60 inches. In other places a few pebbles are in the soil. In some areas the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Bayard soils, which are darker than the Mitchell soil, have more sand in the profile, and are on the lower foot slopes. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Mitchell soil, and available water capacity is high. Runoff is medium. The organic matter content is low. The water intake rate is moderate.

Most of the acreage of this soil is used as rangeland. Some areas are used for cultivated crops. A few acres are irrigated.

If used for dryland crops, this soil is suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn; wheat; dry, edible beans; and alfalfa. Water can be applied by a sprinkler irrigation system. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade. Soil blowing and water erosion are the main hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve water. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can

help to control erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, sideoats grama, and blue grama. These species make up 40 percent or more of the total annual forage. Buffalograss, needleandthread, western wheatgrass, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by hairy grama, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The species selected for planting should be those that can tolerate a high amount of calcium. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of insufficient rainfall. Cultivation between the rows and careful use of herbicides in the row help to control undesirable grasses and weeds. Planting trees on the contour and terracing help to control runoff and water erosion.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded.

This soil is assigned to capability units Ille-3, dryland, and Ille-6, irrigated; Limy Upland range site; and windbreak suitability group 8.

MkD—Mitchell very fine sandy loam, 6 to 9 percent slopes. This very deep, strongly sloping, well drained soil is on foot slopes and valley side slopes. The soil formed in colluvial and alluvial sediments weathered from siltstone. Areas range from 5 to 150 acres in size.

Typically, the surface layer is light brownish gray, very friable, calcareous very fine sandy loam about 5 inches thick. The transitional layer is pale brown, very friable, calcareous silt loam about 12 inches thick. The underlying material to a depth of 60 inches is very pale brown, calcareous silt loam. In some places siltstone occurs within a depth of 60 inches. In other places a few pebbles are in the soil. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Bayard soils, which are darker than the Mitchell soil, have more sand in the profile, and are on the lower foot slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Mitchell soil, and available water capacity is high. Runoff is rapid. The organic matter content is low. The water intake rate is moderate.

Most of the acreage of this soil is used as rangeland. Some areas are used for cultivated crops.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. A scarcity of rainfall in summer commonly limits the cultivated crops that can be successfully grown. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil helps to maintain tilth, increase the content of organic matter, and improve the water intake rate. Summer fallowing conserves moisture for use during the following growing season.

If irrigated, this soil is poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. A gravity irrigation system is unsuited to this soil because of the slope. Water erosion and soil blowing are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and conserve moisture. The efficient

use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at a proper grade can help to control erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, sideoats grama, and blue grama. These species make up 40 percent or more of the total annual forage. Buffalograss, needleandthread, western wheatgrass, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by hairy grama, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The species selected for planting should be those that can tolerate a high amount of calcium. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of insufficient rainfall. Cultivation between the rows and careful use of herbicides in the row help to control undesirable grasses and weeds.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The moderate permeability

is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded.

This soil is assigned to capability units IVE-3, dryland, and IVE-6, irrigated; Limy Upland range site; and windbreak suitability group 8.

MkE—Mitchell very fine sandy loam, 9 to 20 percent slopes. This very deep, moderately steep and steep, well drained soil is on foot slopes and valley side slopes. The soil formed in colluvial and alluvial sediments weathered from siltstone. Areas range from 5 to more than 100 acres in size.

Typically, the surface layer is brown, very friable, calcareous very fine sandy loam about 5 inches thick. The transitional layer is pale brown, very friable, calcareous very fine sandy loam about 13 inches thick. The underlying material to a depth of 60 inches is calcareous very fine sandy loam. It is pale brown in the upper part and very pale brown in the lower part. In some places siltstone occurs within a depth of 60 inches. In other places a few pebbles are mixed in the soil. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Bayard and Epping soils. Bayard soils are darker than the Mitchell soil. They have more sand in the profile and are on the lower foot slopes. Epping soils have siltstone bedrock within a depth of 20 inches and are higher on the landscape than the Mitchell soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Mitchell soil, and available water capacity is high. Runoff is rapid. The organic matter content is low.

Nearly all of the acreage of this soil supports native grasses and is used as rangeland.

This soil is generally unsuited to farming because of the slope and soil blowing. Overcoming soil blowing and the slope by a system of cultivation generally is not practical.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, sideoats grama, and blue grama. These species make up 40 percent or more of the total annual forage. Buffalograss, needleandthread, western wheatgrass, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by hairy grama, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The species selected for planting should be those that can tolerate a high amount of calcium. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control runoff and water erosion. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of insufficient rainfall. Cultivation between the rows and careful use of the appropriate herbicide in the row help to control undesirable grasses and weeds.

This soil generally is not suited to septic tank absorption fields in those areas where the slope is more than 15 percent. In those areas where the slope is less than 15 percent, land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field generally can overcome this limitation. Buildings and dwellings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Cutting and filling can provide a suitable grade for roads.

This soil is assigned to capability unit VIe-3, dryland; Limy Upland range site; and windbreak suitability group 8.

Pg—Pits, sand and gravel. This map unit consists mainly of very deep, gently sloping to steep mounds of gravel, sand, and overburden and the adjacent pits that have nearly level bottoms and nearly vertical side slopes. The areas are on uplands and in some places on flood plains. The pits on the flood plains contain

water, and the surrounding areas are subject to rare flooding. The areas of sand and gravel are excessively drained. Areas generally are irregular in shape and range from 5 to 15 acres in size.

Typically, the soil material consists of a mixture of medium and fine sand, some gravel, and some loamy material. A soil profile has not developed. In some places sandstone bedrock is exposed on the pit bottoms.

This map unit is assigned to capability unit VIII-8, dryland. It is not assigned to a windbreak suitability group or to a range site.

ReG—Rock outcrop-Epping complex, 11 to 60 percent slopes. This map unit consists of areas of very steep Rock outcrop and a shallow Epping soil on upland breaks. The areas of Rock outcrop consist of siltstone and are on the steeper parts of ridgetops and dissected side slopes of upland breaks. The Epping soil is steep and very steep and well drained. It is on side slopes of upland breaks and narrow ridgetops. It formed in material weathered from siltstone containing volcanic ash. Areas are long and narrow and range from 5 to more than 300 acres in size. They are 35 to 60 percent areas of Rock outcrop and 30 to 55 percent Epping soil.

Typically, the areas of Rock outcrop consist of limy siltstone bedrock.

Typically, the Epping soil has a surface layer of pale brown, very friable, calcareous loam about 4 inches thick. The transitional layer is pale brown, very friable, calcareous silt loam about 4 inches thick. The underlying material to a depth of 10 inches is very pale brown, calcareous silt loam. Below a depth of 10 inches it is siltstone bedrock. In some places the soil is moderately deep to siltstone bedrock.

Included with this unit in mapping are small areas of the very deep Mitchell soils, which are on foot slopes that are lower on the landscape than the Epping soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Epping soil. Runoff is rapid in the Epping soil and very rapid in areas of Rock outcrop. Available water capacity is very low in the Epping soil. The organic matter content is low in the Epping soil. The root zone is shallow in the Epping soil.

Nearly all of the acreage of this map unit supports native grasses and is used as rangeland. This unit is unsuited to farming because of the excessive slope, a shallow root zone, the hazard of erosion, and the areas of Rock outcrop.

If the Epping soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, western wheatgrass, blue grama, and threadleaf sedge. These species make up 65 percent or more of the total annual forage. Prairie sandreed, needleandthread, and

forbs make up the rest. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site.

The Epping soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

The Epping soil generally is not suited to septic tank absorption fields because of the steep and very steep slopes and the shallow depth to bedrock. A suitable alternative site should be selected. Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. Cutting and filling can provide a suitable grade for roads. The soft bedrock generally can be excavated during the construction of roads.

This complex is assigned to capability unit VII-4, dryland. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10. The areas of Rock outcrop are not assigned to interpretive groupings.

RhG—Rock outcrop-Tassel complex, 20 to 60 percent slopes. This map unit consists of areas of sandstone Rock outcrop and a shallow Tassel soil on uplands. The Tassel soil is steep and very steep and is well drained. The areas of sandstone Rock outcrop are on the upper part of side slopes, the summits of narrow ridgetops, and the upper part of dissected side slopes. The Tassel soil formed in calcareous material weathered from fine grained sandstone. It is on dissected side slopes, summits, and shoulders of narrow upland ridgetops. Areas range from 10 to 100 acres in size. They are 35 to 60 percent areas of Rock outcrop and 30 to 55 percent Tassel soil. The areas of Rock outcrop and the Tassel soil occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the areas of Rock outcrop consist of blocky, fine grained sandstone bedrock. In places it is interlayered with cemented and uncemented gravels.

Typically, the Tassel soil has a surface layer of grayish brown, very friable, calcareous loamy very fine sand about 3 inches thick. The transitional layer is brown, very friable, calcareous loamy very fine sand about 3 inches thick. The underlying material to a depth of 12 inches is calcareous loamy very fine sand. The upper part is brown, and the lower part is pale brown. Below a depth of 12 inches is fine grained sandstone bedrock. In some places the soil contains more clay and less sand. In other places carbonates have been leached from the surface.

Included with this unit in mapping are small areas of Busher and Dix soils. Busher soils are deep. They have a darker and thicker surface layer than the Tassel soil and are on convex side slopes that do not exceed 30 percent. Dix soils have very gravelly sand at a depth of 10 to 20 inches. They typically do not have free carbonates and are in landscape positions similar to those of the Tassel soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Tassel soil, and available water capacity is very low. Runoff is rapid in the Tassel soil and very rapid in areas of Rock outcrop. The organic matter content is low in the Tassel soil. The root zone is shallow in the Tassel soil.

Nearly all of the acreage in this map unit is used as rangeland. This complex is unsuited to farming because of the slope, a shallow root zone, the hazard of erosion, and the areas of Rock outcrop.

If the Tassel soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, sand bluestem, and threadleaf sedge. These species make up 55 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and sand bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition on the Tassel soil, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site.

The Tassel soil generally is unsuited to the trees and shrubs grown as windbreaks or to plantings that enhance wildlife habitat. Small areas are suitable sites

for planting trees; however, onsite investigation is needed.

The Tassel soil generally is not suited to sanitary facilities and dwellings because of the slope and the shallowness to bedrock. A suitable alternative site should be selected. The soft bedrock generally can be excavated during the construction of roads. Cutting and filling can provide a suitable grade for roads.

This complex is assigned to capability unit VIIIs-4, dryland. The Tassel soil is in the Shallow Limy range site and windbreak suitability group 10. The areas of Rock outcrop are not assigned to interpretive groupings.

Ro—Rosebud loam, 0 to 1 percent slopes. This moderately deep, nearly level, well drained soil is on broad upland divides. It formed in loamy, calcareous material that weathered from weakly cemented, fine grained, limy sandstone. Areas range from 5 to 30 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsoil is about 12 inches thick. The upper part is brown, firm clay loam; the next part is brown and pale brown, firm clay loam; and the lower part is pale brown, friable, calcareous loam. The underlying material to a depth of 23 inches is very pale brown, calcareous sandy loam. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In places the soil contains more silt and less sand and is deep over bedrock.

Included with this soil in mapping are small areas of Canyon soils, which contain less clay than the Rosebud soil and have carbonates at shallower depths. They are shallow over bedrock and are in the steeper areas. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Rosebud soil, and available water capacity is low. Runoff is slow. The organic matter content is moderate. The root zone is moderately deep. The water intake rate is moderate.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If irrigated, this soil is suited to corn; alfalfa; dry,

edible beans; and wheat. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application helps to control water erosion and runoff. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. During land leveling, care should be taken not to expose the underlying bedrock.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. Supplemental water can be provided by an irrigation system during dry periods. A cover crop between the rows helps to control soil blowing. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely use of the appropriate herbicide.

Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the fields. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. A good surface drainage system can minimize the damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIc-1, dryland,

and I-4, irrigated; Silty range site; and windbreak suitability group 6R.

RoB—Rosebud loam, 1 to 3 percent slopes. This moderately deep, very gently sloping, well drained soil is on side slopes and summits in the uplands. It formed in loamy, calcareous material that weathered from weakly cemented, fine grained, limy sandstone. Areas range from 5 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 4 inches thick. The subsoil is friable and about 26 inches thick. The upper part is dark grayish brown clay loam, the next part is brown loam, the next part is light brownish gray, calcareous loam, and the lower part is light gray, calcareous loam. The underlying material is white, weakly cemented, fine grained, limy sandstone bedrock to a depth of 60 inches. In some areas the soil contains more silt and less sand and is deep over bedrock.

Included with this soil in mapping are small areas of Altvan and Canyon soils. Altvan soils are in landscape positions similar to those of the Rosebud soil. They have gravelly sand at a depth of 20 to 40 inches. Canyon soils contain less clay than the Rosebud soil and have carbonates at shallower depths. They are shallow over bedrock and are in the steeper areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Rosebud soil, and available water capacity is low. Runoff is medium. The organic matter content is moderate. The root zone is moderately deep. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop

residue on the surface helps to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. During land leveling, care should be taken not to expose the underlying bedrock.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat (fig. 14). The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. Supplemental water can be provided by an irrigation system during dry periods. Water erosion is a hazard. Planting trees on the contour and terracing help to control water erosion. A cover crop between the rows helps to control soil blowing. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely use of the appropriate herbicide.

Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the fields. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. A good surface drainage system can minimize the damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; and windbreak suitability group 6R.

RoC—Rosebud loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on

side slopes in the uplands. It formed in loamy, calcareous material that weathered from weakly cemented, fine grained, limy sandstone. Areas range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsoil is friable and about 16 inches thick. The upper part is grayish brown and brown clay loam; the next part is brown clay loam; and the lower part is very pale brown, calcareous loam. The underlying material to a depth of 35 inches is pale brown, calcareous very fine sandy loam. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In some places the surface layer is thinner. In other places the soil contains more silt and less sand and is deep to sandstone.

Included with this soil in mapping are small areas of Altvan, Canyon, and Sidney soils. Altvan soils are in landscape positions similar to those of the Rosebud soil. They have gravelly sand at a depth of 20 to 40 inches. The shallow Canyon soils are on ridges, side slopes, and knolls. Sidney soils are in landscape positions similar to those of the Rosebud soil. They contain more sand and less clay in the subsoil and are deep. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Rosebud soil, and available water capacity is low. Runoff is medium. The organic matter content is moderate. The root zone is moderately deep. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. Water erosion and soil blowing are hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control water erosion and soil blowing. The efficient use of irrigation water is a



Figure 14.—A windbreak in an area of Rosebud loam, 1 to 3 percent slopes.

management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at a proper grade can help to control erosion. A gravity irrigation system is poorly suited to this soil because of the slope. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If this soil needs to be land leveled, care should be taken not to expose the underlying bedrock.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize

severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control water erosion. A cover crop between the rows helps to control soil blowing. The lack of seasonal rainfall is the main limitation. Supplemental water can be provided by an irrigation system during dry periods. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely use of the appropriate herbicide.

Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the soil. The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. Small commercial buildings should be designed so that they conform to the natural slope of

the land, or the soil and soft bedrock can be graded. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVE-1, dryland, and IIIE-4, irrigated; Silty range site; and windbreak suitability group 6R.

RsD—Rosebud-Canyon complex, 3 to 9 percent slopes. These gently sloping and strongly sloping, well drained soils are on uplands. The Rosebud soil is moderately deep, and the Canyon soil is shallow. These soils formed in loamy, calcareous material that weathered from weakly cemented, fine grained, limy sandstone. The Rosebud soil is on side slopes and summits. The Canyon soil is on narrow ridgetops and convex shoulders of dissected side slopes. Areas range from 5 to 400 acres in size. They are 40 to 65 percent Rosebud soil and 25 to 50 percent Canyon soil. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Rosebud soil has a surface layer of dark grayish brown, friable loam about 4 inches thick. The subsoil is friable clay loam about 13 inches thick. The upper part is dark brown, and the lower part is pale brown and calcareous. The underlying material to a depth of 33 inches is pale brown and calcareous. It is sandy clay loam in the upper part and sandy loam in the lower part. To a depth of 60 inches it is white and very pale brown, weakly cemented, fine grained, limy sandstone bedrock. In some places the soil contains less clay. In other places the soil contains more silt and less sand and is deep over bedrock.

Typically, the Canyon soil has a surface layer of dark grayish brown, friable loam about 4 inches thick. The transitional layer is brown, friable, calcareous loam about 4 inches thick. The underlying material is brown, calcareous loam to a depth of 15 inches. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In some places the soil has less clay.

Included with these soils in mapping are small areas of Altvan and Sidney soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Canyon soil and contain more clay. Sidney soils contain more sand and less clay in the control section than the Rosebud soil. They are deep and are in landscape positions similar to those of the Rosebud soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Rosebud and Canyon soils. Available water capacity is low in the Rosebud soil and very low in the Canyon soil. Runoff is medium

on both soils. The organic matter content is moderate in the Rosebud soil and low in the Canyon soil. The root zone is moderately deep in the Rosebud soil and shallow in the Canyon soil.

Most of the acreage of these soils supports grasses and is used as rangeland. A few areas are used for cultivated crops.

If used for dryland crops, these soils are poorly suited to winter wheat and millet. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure improve tilth and the water intake rate and increase the content of organic matter.

If the Rosebud soil is used as range or hayland, the climax vegetation is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 60 percent or more of the total annual forage. Buffalograss, needleandthread, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the Canyon soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, hairy grama, big bluestem, and threadleaf sedge. These species make up 70 percent or more of the total annual forage. Other grasses and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the range is in excellent condition on the Rosebud soil, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture

if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If the Rosebud soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

If the range is in excellent condition on the Canyon soil, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may be needed to control the woody plants that invade the site.

The Rosebud soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion is a severe hazard. Planting trees on the contour and terracing help to control water erosion. The lack of seasonal rainfall is the main limitation. Supplemental water can be provided by an irrigation system during dry periods. A cover crop between the rows helps to control soil blowing. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely use of the appropriate herbicide.

The Canyon soil generally is unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

On the Rosebud soil, building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the field. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. The Canyon soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. On these soils the soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations. Small commercial buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded.

On the Rosebud soil, a good surface drainage system can minimize the damage to roads caused by

frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. On the Canyon soil, the soft bedrock generally can be excavated during the construction of roads. In areas of these soils that have slope of more than 8 percent, cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit IVe-1, dryland. The Rosebud soil is in the Silty range site, and the Canyon soil is in the Shallow Limy range site. The Rosebud soil is in windbreak suitability group 6R, and the Canyon soil is in windbreak suitability group 10.

Sb—Satanta loam, gravelly substratum, 0 to 1 percent slopes. This very deep, nearly level, well drained soil is on broad uplands. It formed in loamy eolian or alluvial sediments over gravelly loamy sand. Areas range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 4 inches thick. The subsurface layer is grayish brown, very friable loam about 3 inches thick. The subsoil is friable and about 22 inches thick. The upper part is grayish brown clay loam, the next part is light brownish gray, calcareous loam, and the lower part is very pale brown, calcareous loam. The underlying material to a depth of 60 inches is very pale brown and calcareous. It is loam in the upper part and gravelly loamy sand in the lower part. In some places the soil has a dark buried horizon in the subsoil. In other places the soil has a thicker dark surface layer. In some areas the soil contains more silt and less sand and does not have sand and gravel.

Included with this soil in mapping are small areas of Alliance, Altvan, and Duroc soils. Alliance soils are in landscape positions similar to those of the Satanta soil. They have weakly cemented, fine grained, limy sandstone bedrock below a depth of 40 inches. They contain more silt and less sand than the Satanta soil. Altvan soils are in landscape positions similar to those of the Satanta soil. They have gravelly sand at a depth of 20 to 40 inches. Duroc soils have less sand throughout the profile than the Satanta soil. They have a dark surface layer that is more than 20 inches thick and are in swales and drainageways. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the solum and the upper part of the underlying material of the Satanta soil and is rapid in the lower part of the underlying material. Available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Only a small

acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Insufficient moisture during years of below normal rainfall is the main limitation. Soil blowing is a slight hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to conserve moisture and control soil blowing. Returning crop residue to the soil and applying manure improve the water intake rate.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Soil blowing is a slight hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and ponding. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, soil blowing is excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for

septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The sides of shallow excavations can cave in unless they are shored. This soil generally is suited to dwellings. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units 11c-1, dryland, and 1-4, irrigated; Silty range site; and windbreak suitability group 3.

SbB—Satanta loam, gravelly substratum, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on upland side slopes and high stream terraces. It formed in loamy eolian or alluvial sediments over gravelly loamy sand. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 6 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is friable and about 17 inches thick. The upper part is brown clay loam, the next part is pale brown clay loam, and the lower part is very pale brown, calcareous loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is loam, the next part is fine sandy loam, and the lower part is gravelly loamy sand. In some places the soil has a dark buried horizon in the subsoil. In other places the soil has a thicker dark surface layer. In some areas the underlying material does not have gravelly loamy sand.

Included with this soil in mapping are small areas of Alliance, Altvan, and Rosebud soils. The included soils are in landscape positions similar to those of the Satanta soil. Alliance soils contain more silt and less sand than the Satanta soil. They are deep to weakly cemented, fine grained, limy sandstone bedrock. Altvan soils have gravelly sand at a depth of 20 to 40 inches. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the solum and the upper part of the underlying material of the Satanta soil and is rapid in the lower part of the underlying material. Available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately low.

Nearly all of the acreage of this soil is used for

cultivated crops. A few areas are irrigated. Only a small acreage supports grasses and is used for hay or grazing.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by gravity or sprinkler irrigation systems. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control water erosion. Returning crop residue to the soil and applying manure help improve tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. Timely application and efficient distribution of water are needed. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. The lack of seasonal rainfall is the

main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide. Planting on the contour helps to control water erosion.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The sides of shallow excavations can cave in unless they are shored. This soil generally is suited to dwellings. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units 11e-1, dryland, and 11e-4, irrigated; Silty range site; and windbreak suitability group 3.

SbC—Satanta loam, gravelly substratum, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on upland side slopes and high stream terraces. It formed in loamy eolian or alluvial sediments over gravelly sandy loam. Areas range from 10 to 40 acres in size.

Typically, the surface layer is grayish brown, friable loam about 5 inches thick. The subsurface layer is grayish brown, friable loam about 5 inches thick. The subsoil is friable and about 17 inches thick. The upper part is light brownish gray clay loam, and the lower part is pale brown, calcareous loam. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is loam, and the lower part is gravelly sandy loam. In some places weakly cemented, fine grained, limy sandstone is below a depth of 40 inches. In other places the soil has less sand and gravel throughout the profile.

Included with this soil in mapping are small areas of Altvan and Rosebud soils. The included soils are in landscape positions similar to those of the Satanta soil. Altvan soils have gravelly sand at a depth of 20 to 40 inches. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the solum and the upper part of the underlying material of the Satanta soil and is rapid in the lower part of the underlying material.

Available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately low.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade help to control erosion. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. Water erosion is a severe hazard.

Planting the trees on the contour and terracing help to control water erosion. The lack of seasonal rainfall is the main limitation. A drip irrigation system can be used to provide additional water as needed. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. The sides of shallow excavations can cave in unless they are shored. This soil generally is suited to dwellings. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; and windbreak suitability group 3.

SnC—Sidney loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes in the uplands. The soil formed in loamy, calcareous colluvium that weathered from weakly cemented, fine grained, limy sandstone. Areas of this soil range from 5 to 30 acres in size.

Typically, the surface layer is brown, very friable, calcareous loam about 7 inches thick. The subsoil is pale brown, very friable, calcareous loam about 12 inches thick. The underlying material to a depth of 50 inches is very pale brown, calcareous loam. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In some places the subsoil contains more clay.

Included with this soil in mapping are small areas of Altvan and Rosebud soils. The included soils are in landscape positions similar to those of the Sidney soil. Altvan soils have more clay in the subsoil than the Sidney soil. They have gravelly sand at a depth of 20 to 40 inches. Rosebud soils have more clay in the subsoil than the Sidney soil. They are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Sidney soil, and available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderately low.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion.

A sprinkler irrigation system can be used on this soil. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are good. Water erosion is a severe hazard. The lack of seasonal rainfall is the main limitation. Planting trees on the contour and terracing help to control water erosion. An irrigation system can provide

the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation. Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the fields. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. A good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated; Silty range site; and windbreak suitability group 3.

SoD—Sidney-Canyon complex, 3 to 9 percent slopes. These gently sloping and strongly sloping, well drained soils are on uplands. The Sidney soil is deep, and the Canyon soil is shallow. The Sidney soil is on side slopes in the uplands and formed in loamy, calcareous colluvium that weathered from weakly cemented, fine grained, limy sandstone. The Canyon soil is on narrow ridgetops and convex shoulders of dissected side slopes and formed in material that weathered from weakly cemented, fine grained, limy sandstone. Areas range from 5 to 400 acres in size. They are 40 to 60 percent Sidney soil and 30 to 50 percent Canyon soil. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Sidney soil has a surface layer of grayish brown, friable, calcareous loam about 7 inches thick. The subsoil is light brownish gray, friable, calcareous loam about 11 inches thick. The underlying material to a depth of 50 inches is calcareous loam. The upper part is very pale brown, and the lower part is light gray. To a depth of 60 inches it is white, weakly cemented, fine grained, limy sandstone bedrock. In some places the soil contains more clay.

Typically, the Canyon soil has a surface layer of dark grayish brown, friable, calcareous loam about 6 inches thick. The underlying material to a depth of 11 inches is brown, calcareous gravelly loam. To a depth of 60 inches it is weakly cemented, fine grained, limy sandstone bedrock. In some places the soil has less clay. In other places the soil has a stony surface.

Included with these soils in mapping are small areas of Altvan and Rosebud soils. The included soils are in

landscape positions similar to those of the Sidney and Canyon soils. Altvan soils have more clay in the subsoil than the Sidney and Canyon soils. They have gravelly sand at a depth of 20 to 40 inches. Rosebud soils have more clay in the subsoil than the Sidney and Canyon soils. They are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Sidney and Canyon soils. Available water capacity is moderate in the Sidney soil and very low in the Canyon soil. Runoff is medium on both soils. The organic matter content is moderately low in the Sidney soil and low in the Canyon soil. The root zone is deep in the Sidney soil and shallow in the Canyon soil.

Most of the acreage of these soils is used for cultivated crops. Some areas support grasses and are used as rangeland. A few small areas are irrigated.

If used for dryland crops, these soils are poorly suited to winter wheat and millet. Water erosion is a severe hazard and soil blowing is a moderate hazard in areas where the surface is not adequately protected by crops or crop residue. In cultivated areas, most of the original surface layer has been removed by erosion, and the thickness of the loamy material over the sandstone bedrock has been reduced in the Canyon soil. In these areas numerous sandstone fragments have been dislodged by tillage equipment and are on the surface of the soil. The surface layer in these areas is light in color and calcareous. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure improve tilth, increase the organic matter content, and improve the water intake rate. These soils are poorly suited to irrigation because of the slopes and the shallowness to sandstone bedrock in the Canyon soil.

The Sidney soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

The Canyon soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the amount

of protective cover and the quality of the native plants. Proper grazing use, timely deferment from grazing, and a planned grazing system help keep the native plants in good condition. Brush management may be needed to control undesirable woody plants that invade the site.

The Sidney soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The Canyon soil generally is unsuited. The survival and growth rates of adapted species are good on the Sidney soil. Small areas are suitable sites for planting trees on the Canyon soil; however, onsite investigation is needed.

On the Sidney soil, water erosion is a severe hazard. The lack of seasonal rainfall is the main limitation. Planting trees on the contour and terracing help to control water erosion. An irrigation system can provide the supplemental moisture needed during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by applications of the appropriate herbicide.

On the Sidney soil, the moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the fields. The Canyon soil generally is not suited to septic tank absorption fields because it is shallow over bedrock. A suitable alternative site should be selected. On the Canyon soil, the soft bedrock generally can be easily excavated during the construction of dwellings with basements. In areas of these soils that have slope of 8 percent or more, buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be excavated.

On the Sidney soil, a good surface drainage system can minimize the damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. On the Canyon soil, the bedrock generally can be excavated during the construction of roads. In areas of these soils that have slope of 8 percent or more, cutting and filling are needed to provide a suitable grade for roads.

These soils are assigned to capability unit IVE-1, dryland. The Sidney soil is in the Silty range site, and the Canyon soil is in the Shallow Limy range site. The Sidney soil is in windbreak suitability group 3, and the Canyon soil is in windbreak suitability group 10.

TbF—Tassel-Busher complex, 3 to 30 percent slopes. These gently sloping to steep, well drained soils are on uplands. The shallow Tassel soil is on summits

and side slopes of narrow ridgetops; dissected, convex side slopes; and sharp slope breaks. The deep Busher soil is on convex summits and side slopes. These soils formed in material that weathered from fine grained sandstone. Areas range from 10 to more than 100 acres in size. They are 40 to 60 percent Tassel soil and 30 to 50 percent Busher soil. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Tassel soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 3 inches thick. The subsurface layer is brown, very friable, calcareous loamy very fine sand about 3 inches thick. The underlying material is pale brown, calcareous, loamy very fine sand. Weakly cemented, fine grained sandstone bedrock is at a depth of about 13 inches. In some places the soil contains more clay. In other places the depth to sandstone bedrock is less than 6 inches.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable fine sandy loam about 18 inches thick. The subsoil is brown, very friable, calcareous fine sandy loam about 12 inches thick. The underlying material is pale brown, calcareous fine sandy loam about 25 inches thick. To a depth of 60 inches it is white, fine grained sandstone bedrock. In some places the surface layer is loamy very fine sand. In other places the carbonates are leached from the profile. In some areas the surface layer is lighter in color and thinner.

Included with these soils in mapping are small areas of Dix soils and outcrops of sandstone. Dix soils are in landscape positions similar to those of the Tassel and Busher soils. They are excessively drained and have very gravelly sand at a depth of 10 to 20 inches. The outcrops of sandstone are on narrow ridgetops and sharp slope breaks. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Tassel and Busher soils. Runoff is medium on both soils. Available water capacity is very low in the Tassel soil and moderate in the Busher soil. The organic matter content is low in the Tassel soil and moderately low in the Busher soil. The root zone is shallow in the Tassel soil and deep in the Busher soil.

Nearly all of the acreage of these soils supports native grasses and is used as rangeland. A few small areas have scattered trees.

These soils are unsuited to farming because of the slope and the shallow root zone in areas of the Tassel soil.

If the Tassel soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, sand bluestem, and threadleaf sedge.

These species make up 55 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and sand bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the Busher soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre on the Tassel soil and 0.5 animal unit month per acre on the Busher soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. These soils generally are the first to be overgrazed when they are in a pasture that includes the Sands range site. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If the Busher soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

These soils are generally unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites for planting trees; however, onsite investigation is needed.

These soils generally are not suited to sanitary facilities because of the steep slopes of both soils and the shallowness over bedrock of the Tassel soil. A suitable alternative site should be selected. The sides of shallow excavations in the Busher soil can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or

the soil and soft bedrock can be graded. The soft bedrock generally can be easily excavated during the construction of dwellings with basements. The soft bedrock generally can be excavated during the construction of roads. Cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit VIs-4, dryland. The Tassel soil is in the Shallow Limy range site, and the Busher soil is in the Sandy range site. These soils are in windbreak suitability group 10.

TcG—Tassel-Busher-Rock outcrop complex, 11 to 60 percent slopes. These steep and very steep, well drained soils and areas of Rock outcrop are on uplands. The shallow Tassel soil is on narrow ridgetops and the upper part of dissected side slopes. The deep Busher soil is on side slopes that are typically less than 30 percent. The Tassel and Busher soils formed in material that weathered from fine grained sandstone. The areas of sandstone Rock outcrop are on ridgetops and the upper part of side slopes. Areas range from 20 to 240 acres in size. They are 40 to 60 percent Tassel soil, 20 to 30 percent Busher soil, and 10 to 20 percent areas of Rock outcrop. The two soils and the areas of Rock outcrop are so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the Tassel soil has a surface layer of grayish brown, very friable loamy very fine sand about 3 inches thick. The subsurface layer is brown, very friable, calcareous loamy very fine sand about 5 inches thick. The underlying material is brown, calcareous loamy very fine sand. White, fine grained sandstone bedrock is at a depth of about 14 inches. In some places the soil contains more clay and less sand.

Typically, the Busher soil has a surface layer of grayish brown, very friable fine sandy loam about 10 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 3 inches thick. The subsoil is pale brown, very friable very fine sandy loam about 12 inches thick. The underlying material is pale brown, loamy very fine sand to a depth of 42 inches. The lower part is calcareous. It is white, fine grained sandstone bedrock to a depth of 60 inches or more. In some places the soil contains more sand. In other places the carbonates are leached from the profile.

Typically, the areas of Rock outcrop consist of fine grained sandstone. Thin to thick layers of strongly cemented sandstone alternate with layers of weakly cemented sandstone. In some places at similar elevations are outcrops of gravel.

Included with this unit in mapping are small areas of the excessively drained Dix soils, which have very

gravelly coarse sand at a depth of 10 to 20 inches and are on narrow ridgetops. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the Tassel and Busher soils. Runoff is rapid in the Tassel and Busher soils and is very rapid in the areas of Rock outcrop. Available water capacity is very low in the Tassel soil and moderate in the Busher soil. The organic matter content is low in the Tassel soil and moderately low in the Busher soil. The root zone is shallow in the Tassel soil and deep in the Busher soil.

Nearly all of the acreage in this map unit supports native grasses and savannah vegetation of native grasses interspersed with trees and is used as rangeland (fig. 15).

This unit is unsuited to farming because of the slope and the shallow root zone in areas of the Tassel soil and the areas of Rock outcrop.

If the Tassel soil is used as range, the climax vegetation is dominantly little bluestem, sideoats grama, blue grama, sand bluestem, and threadleaf sedge. These species make up 55 percent or more of the total annual forage. Prairie sandreed, needleandthread, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem and sand bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, woody plants may invade the site.

If the Busher soil is used as range, the climax vegetation is dominantly little bluestem, needleandthread, prairie sandreed, and threadleaf sedge. These species make up 60 percent or more of the total annual forage. Other perennial grasses, forbs, and shrubs make up the rest. Ponderosa pine covers 5 to 15 percent of the area. If subject to continuous heavy grazing, little bluestem decreases in abundance and is replaced by hairy grama, needleandthread, and prairie sandreed. If overgrazing continues for many years, the woody plants increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope and the rocky terrain can hinder the movement of livestock. Brush management may be needed to control woody plants that invade the site.

These soils are generally unsuited to trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. Small areas are suitable sites

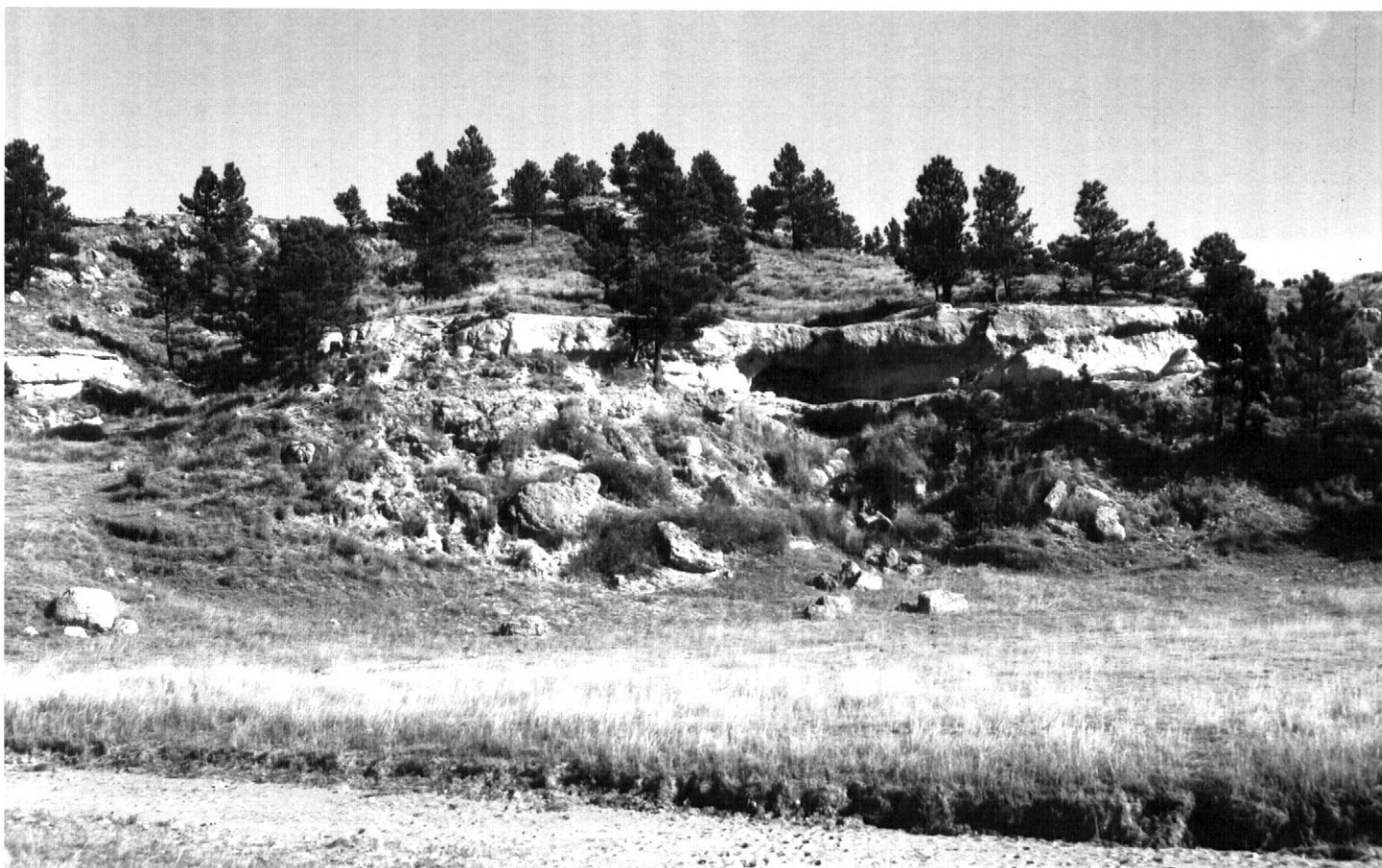


Figure 15.—An area of rangeland on Tassel-Busher-Rock outcrop complex, 11 to 60 percent slopes.

for planting trees; however, onsite investigation is needed.

These soils generally are not suited to septic tank absorption fields because of the slope of both soils and the shallowness over bedrock of the Tassel soil. A suitable alternative site should be selected. The sides of shallow excavations in the Busher soil can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock can be graded. The soft bedrock generally can be excavated during the construction of roads. Cutting and filling can provide a suitable grade for roads.

These soils are assigned to capability unit VII_s-4, dryland. The Tassel soil is in the Shallow Limy range site, and the Busher soil is in the Savannah range site. Both soils are in windbreak suitability group 10. The Rock outcrop is not assigned to interpretive groupings.

UyB—Ulysses loam, 1 to 3 percent slopes. This very deep, very gently sloping, well drained soil is on side slopes and summits in the uplands. It formed in calcareous loess. Areas range from 10 to more than 200 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is grayish brown, friable loam about 6 inches thick. The subsoil is friable, calcareous silt loam about 12 inches thick. The upper part is brown, and the lower part is pale brown. The underlying material to a depth of 60 inches is very pale brown, calcareous silt loam. In some areas the dark surface layer is thicker. In other areas the soil has a buried horizon. In a few areas carbonates are at or near the surface.

Included with this soil in mapping are small areas of Alliance, Keith, and Rosebud soils. The included soils are in landscape positions similar to those of the

Ulysses soil. Alliance and Keith soils contain more clay in the subsoil than the Ulysses soil. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and contain more clay in the subsoil than the Ulysses soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Ulysses soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Contour farming helps to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity or sprinkler irrigation system can be used on this soil. Less land preparation is needed if a sprinkler irrigation system is used. Timely application and efficient distribution of water are needed. If a gravity irrigation system is used, land leveling is needed to provide a proper grade. In areas that are cut during land leveling, the organic matter content can be increased by returning crop residue to the soil. The soil commonly is deficient in phosphorus and zinc in cut areas. Reducing the grade in the row by adjusting the direction of the row results in an even distribution of water and helps to control erosion and increase the water intake rate. A tailwater recovery system can be constructed to conserve water.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of

the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. The lack of seasonal rainfall is the main limitation. An irrigation system can provide the supplemental moisture needed during periods of insufficient rainfall. Cultivation between the rows and careful use of the appropriate herbicide in the row help to control undesirable grasses and weeds. Planting trees on the contour and terracing help to control runoff and water erosion.

This soil generally is suited to septic tank absorption fields. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units 11e-1, dryland, and 11e-6, irrigated; Silty range site; and windbreak suitability group 3.

UyC—Ulysses loam, 3 to 6 percent slopes. This very deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in calcareous loess. Areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is brown, very friable loam about 3 inches thick. The subsoil is friable, calcareous silt loam about 10 inches thick. The upper part is pale brown, and the lower part is very pale brown. The underlying material is very pale brown and calcareous to a depth of 60 inches. The upper part is silt loam, and the lower part is very fine sandy loam. In some areas the dark surface soil is thicker. In a few areas carbonates are at or near the surface.

Included with this soil in mapping are small areas of Alliance, Keith, and Rosebud soils. Alliance soils are in landscape positions similar to those of the Ulysses soil. They have more clay in the subsoil and have weakly cemented, fine grained, limy sandstone at a depth of 40 to 60 inches. Keith soils have more clay in the subsoil than the Ulysses soil. They are deeper to free carbonates and are typically on the slightly higher side slopes and upland divides. Rosebud soils are in landscape positions similar to those of the Ulysses soil.

They are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and contain more clay in the subsoil. Included soils make up 10 to 15 percent of this unit.

Permeability is moderate in the Ulysses soil, and available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for cultivated crops. A few areas are irrigated. Some areas are used as rangeland.

If used for dryland crops, this soil is suited to winter wheat and millet. Soil blowing and water erosion are moderate hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control soil blowing and water erosion and conserve moisture. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion.

If irrigated, this soil is suited to corn; alfalfa; dry, edible beans; and wheat. Water can be supplied by a sprinkler irrigation system. Water erosion is the principal hazard. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help to control erosion. Timely application and efficient distribution of water are needed. The proper rate of water application and the use of terraces help to control water erosion and runoff. A gravity irrigation system is poorly suited to this soil because of the slope. Less land preparation is needed if a sprinkler irrigation system is used. If a gravity irrigation system is used, extensive land leveling is needed to provide a proper grade.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the amount of protective cover and the quality of the native plants. As a result, water erosion and soil blowing are excessive. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help keep the native plants in good condition. Range seeding may be needed to stabilize

severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Water erosion and soil blowing are principal hazards. The lack of seasonal rainfall is the main limitation. Planting trees on the contour and terracing help to control runoff and water erosion. An irrigation system can provide the supplemental moisture needed during periods of insufficient rainfall. Cultivation between the rows and careful use of the appropriate herbicide in the row help to control undesirable grasses and weeds.

This soil is generally suited to septic tank absorption fields. The foundations of dwellings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land, or the soil can be graded. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated; Silty range site; and windbreak suitability group 3.

VdD—Valent loamy fine sand, 6 to 9 percent slopes. This very deep, strongly sloping, excessively drained soil is on narrow ridgetops and side slopes in the dunelike uplands. It formed in uniform sandy eolian material that weathered from a variety of sources. Areas range from 5 to 60 acres in size.

Typically, the surface layer is brown, very friable loamy fine sand about 6 inches thick. The transitional layer is brown, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches is loamy fine sand. The upper part is pale brown, and the lower part is calcareous and light gray and very pale brown. In some places the surface soil is thicker and darker. In other places free carbonates are nearer to the surface.

Included with this soil in mapping are small areas of Busher, Duroc, Jayem, and Keith soils. Busher soils have a dark surface layer that is thicker than that of the Valent soil. They have sandstone between a depth of 40 to 60 inches and are on ridgetops and convex side slopes. Duroc soils contain more clay and less sand in the profile than the Valent soil. They have a dark surface layer that is more than 20 inches thick and are on narrow upland drainageways and in swales. Jayem soils are in landscape positions similar to those of the Valent soil and are loamy. Keith soils have a dark

surface layer that is thicker than that of the Valent soil. They contain more clay and less sand in the profile than the Valent soil and are on upland divides and side slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil is used as rangeland. A few small areas are cultivated and are used for dryland farming.

If used for dryland crops, this soil is poorly suited to winter wheat and millet. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as stubble mulch with small grain or no-till plant with row crops, keeps crop residue on the surface and is an effective way to control soil blowing and water erosion and conserve moisture. Stripcropping helps to control soil blowing. Terraces and contour farming help to control water erosion. Returning crop residue to the soil and applying manure help to maintain tilth, increase the content of organic matter, and improve the water intake rate.

If irrigated, this soil is poorly suited to corn; alfalfa; dry, edible beans; and wheat. Water can be applied by a sprinkler irrigation system. Water erosion and soil blowing are severe hazards. A winter cover crop helps to control soil blowing. A system of conservation tillage, such as chiseling or disking, that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing. The efficient use of irrigation water is a management concern because of the slope. Adjusting the water application rate to the water intake rate of the soil helps to control excessive runoff and erosion.

A gravity irrigation system is unsuited to this soil. Because of the slope, this soil cannot be easily managed for irrigated crops.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand

dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks and to plantings that enhance wildlife habitat. The survival and growth rates of adapted species are fair. Soil blowing and water erosion are severe hazards. The lack of seasonal rainfall is the main limitation. Planting trees on the contour and maintaining strips of sod between the rows help to control soil blowing, prevent competition from weeds and undesirable grasses, and control water erosion. The trees need to be planted in shallow furrows with as little disturbance of the soil as possible. Supplemental moisture can be provided by an irrigation system during periods of scarce rainfall.

The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of underground water supplies. The sides of shallow excavations can cave in unless they are shored. In areas where the slope is less than 8 percent, this soil is generally suited to dwellings and roads. In areas where the slope is 8 percent or more, dwellings need to be designed so that they conform to the natural slope of the land, or the soil can be graded. In areas where the slope is 8 percent or more, cutting and filling can provide a suitable grade for roads.

This soil is assigned to capability units Vle-5, dryland, and lVe-11, irrigated; Sands range site; and windbreak suitability group 7.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with

water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 548,000 acres in the survey area, or nearly 72 percent of the total acreage, meets the soil requirements for prime farmland when the soil is irrigated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations or hazards, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify as prime farmland only in areas where these limitations or hazards have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown under the heading "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

William E. Reinsch, conservation agronomist, Natural Resources Conservation Service, Lincoln, Nebraska, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland amounts to about 72 percent of the total farmland in Cheyenne County. Nearly 9 percent of the cultivated cropland is irrigated. Small grains are the main dryland crop. Corn and dry beans are the main irrigated crops. Hay makes up most of the rest of the acreage of cropland, along with other minor crops.

Dryland Farm Management

Although dryland cropland is scattered through the county, the greatest concentration of wheat-fallow rotation is in the north and northeastern parts of the county. Dryland crops are grown mainly on silty soils in the uplands in the Alliance-Duroc-Kuma and Kuma-Keith-Duroc associations.

In the county, insufficient rainfall commonly is a limiting factor affecting crop production. Water and wind are erosive factors that can prevent maximum crop production. Good management in areas used for dryland crops reduces the water runoff rate, controls the hazard of erosion, conserves moisture, and improves tilth.

Stripcropping, the use of crop residue, and a conservation tillage system that keeps crop residue on the surface help to control water erosion. Keeping crop residue on the surface or growing a protective plant

cover minimizes crusting during and after heavy rains. In winter the stubble holds snow on the field and thus increases the moisture supply. Mechanical practices, such as terraces, reduce the length of slopes and thus reduce the water runoff rate and help to control erosion. Level terraces are most practical on long and rather smooth, moderately sloping upland soils.

In the county, erosion is the major problem on nearly all of the soils used as cropland and in areas of pasture that have been overgrazed. All of the soils are susceptible to soil blowing and water erosion. The winds in the county are more westerly in winter and northwesterly in spring. Erosive wind energy is the most severe in April.

Soil blowing is a major problem in the county because of the climatic conditions, but the hazard is not as great as in some of the surrounding counties. For example, in areas of the Alliance soils, the soil layers that are dark are thinner on the A slope than on the B or even on the C slope. This is partly because of the landscape position and exposure to wind. Keeping crop residue on the surface throughout the winter or until planting helps to control soil blowing. A conservation tillage system that leaves crop residue on the surface, along with strip cropping, is the most economical control for soil blowing.

Contour strip cropping, wind strip cropping, and a conservation tillage system can be used to control soil blowing and water erosion on cropland. Contour strip cropping is best suited to soils in areas where water erosion and soil blowing are problems. The strips should be kept narrow because of the direction of the prevailing winds.

Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Soil blowing results in damage to growing crops, rangeland, and the quality of life in the area.

Controlling erosion minimizes the pollution of streams by sedimentation and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

A cropping system and management practices that control erosion should be planned to fit the soil in each field. The sequence of crops grown on a field combined with practices needed for the management and conservation of the soil is known as a Resource Management System. Resource Management Systems for dryland cropland should maintain tilth, fertility, and a surface cover that protects the soil from erosion and help to control weeds, insects, and diseases.

Tilth is an important factor affecting the germination of seeds and infiltration of water into the soil. Soils that have good tilth are granular and porous. Regular additions of crop residue, manure, and other organic

material improve soil structure and tilth.

Resource Management Systems vary according to the soils on which they are used. For example, a Resource Management System for Alliance loam, 3 to 6 percent slopes, would include management practices, such as contour strip cropping 120 foot wide and a minimum of 500 pounds of small grain residue on the surface after planting or vegetative practices, such as a conservation tillage system that maintains 1,000 pounds of small grain residue on the surface or 40 percent of the surface covered with crop residue after planting.

Occasionally, tillage is needed to prepare a seedbed, control weeds, and provide a favorable place for plants to grow. Excessive tillage, however, reduces the plant cover and increases the hazard of erosion. Tillage practices should be limited to those that are essential. Various conservation tillage practices can be used in the county. No-till planting is well suited to small grain and row crops. Grasses and legumes can be established without further seedbed preparation by drilling into a cover of stubble.

Soil fertility is naturally lower in most of the eroded soils and the moderately deep soils than in the uneroded deep soils. All soils, however, require additional plant nutrients for optimum production.

The kind and amount of fertilizer to be applied to the soils used for dryland crops should be based on the results of soil tests. Nitrogen and phosphorus are the elements added to most cultivated areas. In some areas trace elements are needed.

Irrigation Management

Only about 9 percent of the cropland in Cheyenne County is irrigated. Corn and field beans are grown on 54 percent of the irrigated cropland. A smaller acreage is used for alfalfa hay and other crops. The irrigation water is obtained from wells. Sprinkler systems are scattered throughout the county. The greatest concentration of irrigation is along Lodgepole Creek. Gravity or sprinkler systems are suited to the areas used for row crops. Alfalfa is generally irrigated by border, ditch, or sprinkler systems.

The cropping sequence on soils that are well suited to irrigation consists mostly of row crops. A crop rotation that includes different crops, such as corn and field beans, helps to control the diseases and insects that are common if the same crop is grown year after year.

Gently sloping soils, such as Keith loam, 3 to 6 percent slopes, are subject to water erosion if they are furrow irrigated down the slope. If furrow irrigated, these soils should be contour bench leveled, or contour furrows and a ridge-till conservation tillage system

should be used. Land leveling increases the efficiency of irrigation because it results in an even distribution of water.

Contour farming and conservation tillage practices that keep crop residue on the surface help to control both water erosion and soil blowing on soils irrigated by a sprinkler system. When water is applied by the sprinklers at a controlled rate, it is absorbed by the soil and does not run off the surface. Sprinklers can be used on the more sloping soils and on the nearly level soils. Some soils, such as Keith loam, 3 to 6 percent slopes, are suited to sprinkler irrigation only if erosion is controlled. Because the application of water can be carefully regulated, sprinklers can be used for special purposes, such as establishing a new pasture on moderately steep soils. The most common type of sprinkler irrigation in the county is the center-pivot system.

Furrow irrigation is most efficient if it is started after the plants have used about half of the available water in the soil. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches has been removed by the crop.

A tailwater recovery pit can be installed to trap excess irrigation tailwater. This water can then be pumped back onto the field and used again. This practice increases the efficiency of the irrigation system and conserves the water supply.

All of the soils in Nebraska are assigned to irrigation design groups. If applicable, an irrigation capability unit is specified at the end of the map unit descriptions under the heading "Detailed Soil Map Units." The Arabic number at the end of the irrigation capability unit indicates the irrigation design group to which the soil is assigned.

Assistance in planning and designing an irrigation system can be obtained from the local office of the Natural Resources Conservation Service. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Weed Control

A suitable cropping sequence or appropriate herbicides help to control weeds. Rotating different crops in a planned sequence not only helps to control weeds but also increases the productivity of the soil and the content of organic matter. The kind and amount of herbicide applied to the soil should be carefully controlled. The colloidal clay and humus fractions of the soil are responsible for most of the chemical activity in the soil. The applications of some herbicides on sandy soils, such as Dwyer soils, that have low colloidal clay

content and on soils that are low in content of organic matter, such as Mitchell soils, can cause crop damage.

Management of Pasture and Hayland

Areas that are used for hay or pasture should be managed for maximum forage production. After a pasture is established, the grasses should be kept productive. In Cheyenne County pastures of cool-season grasses consist mainly of western wheatgrass, intermediate wheatgrass, and pubescent wheatgrass. These grasses start to grow in the spring and reach their peak growth in May and June. They are dormant during July and August unless the pasture is irrigated. For this reason, these cool-season grasses should be managed in a planned grazing system along with native range pastures. The management of introduced pastures should include a pasture rotation. These grasses are more productive when they are grazed in the spring after the grass has reached a height of 5 or 6 inches. Until the plants reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in the spring or too late in the fall weakens the plants. Other cool-season grasses and legumes that are suited to irrigated areas of the county are brome grass, creeping foxtail, meadow brome grass, reed canarygrass, alfalfa, and cicer milkvetch.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the

irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for windbreaks, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (4). These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them

generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or alkaline; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 and IIle-1.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units," in the yields table, and in the Interpretive Groups that follow the tables at the back of this survey.

Rangeland

Kenneth L. Hladek, range conservationist, Natural Resources Conservation Service, helped prepare this section.

About 25 percent of the acreage in Cheyenne County is native grassland used for grazing or hay.

Supplemental feed for use by livestock is produced in some areas of cropland. The production of beef cattle is an important agricultural enterprise in the county. As a result, proper management of range and hayland is one of the most important parts of the conservation program in the county. Good range management can improve forage yields and thus increase livestock production. This section can aid ranchers and conservationists in planning the management of range. It defines range sites, explains the evaluation of range condition, and

describes planned grazing systems and other aspects of range and hayland management.

Range condition is the present state of the vegetation on a range site compared with the potential, or climax, vegetation on that site. The climax vegetation is a stable plant community that represents the most productive combination of forage plants on a given range site. It reproduces itself naturally and changes little as long as the climate and soil conditions remain unchanged.

Determining the range condition provides an approximate measure of the deterioration that has taken place in the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four condition classes are used to indicate the departure from the potential, or climax, vegetation. They are excellent, good, fair, and poor.

All food that plants use for growth is manufactured in their leaves. The removal of plant leaves during the growing season affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season and the degree of range use. Plants respond to grazing in different ways. Some decrease in abundance, some increase in abundance, and others not originally part of the plant community can invade the range site. These plant responses to grazing are used in classifying the range condition.

The *decreaser species* are those species in the original plant community that decrease in abundance if grazed closely and continuously during the growing season. The *increaser species* are those species in the original plant community that normally increase in abundance as the decreaser plants become less abundant. The *invader species* are those species not in the original plant community that begin to grow on a site after the decreaser and increaser species have been removed or are less extensive.

Once the range condition has been determined, further investigation can indicate whether it is improving or deteriorating in order to adjust grazing use and management. Important factors affecting trends are vigor in the plant community and the reproductive capacity of both desirable and undesirable plant species.

The goal of range management is an excellent range condition. The highest yields are obtained on a sustained basis if the range is in excellent condition. Also, soil blowing and water erosion are kept at a minimum, and maximum use is made of rainfall and snowmelt.

The following paragraphs describe the management

needed on the range in the county. This management includes proper grazing use, planned grazing systems, deferred grazing, range seeding, control of blowouts, brush control, and management of native hayland.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for nearly all of the soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total

annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains enough plant cover to protect the soil and that maintains or improves the quantity and quality of the desirable vegetation. It is the first and most important step in successful range management. It increases the vigor and reproductive capacity of desirable plants, leaves enough accumulated litter and mulch to help control erosion, and increases forage production. The proper degree of grazing on range during the entire growing season removes no more than half of the current year's growth, by weight.

Proper grazing use is determined by the degree to which desirable species are grazed in key areas. It is affected by stocking rates, the distribution of livestock, and the kinds and classes of livestock.

The stocking rate is the number of grazing animals in a particular pasture. It is based on animal units and animal unit months. An *animal unit* is a measurement of livestock numbers based on the equivalent of one mature cow, weighing approximately 1,000 pounds, and a calf that is at least 4 months of age. An *animal unit month* is the forage or feed necessary to sustain an animal unit for 1 month. The range site for each map unit and the range condition are used to determine the animal unit months for each pasture. The proper stocking rates for range sites in excellent condition are given for many of the soils under the heading "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

For example, in an area of Bridget very fine sandy loam, the suggested initial stocking rate is 0.5 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry 320 animal units for 1 month. If the pasture is to be grazed continuously for 5 months, then the suggested initial stocking rate would be 64 animal units. The stocking rate is based on the condition of the existing plant community and the average annual production of each site. Because of the weather conditions, forage production can vary. The suggested rate is intended as an initial stocking rate and should be adjusted to changes in forage production or the management system.

The proper distribution of livestock throughout a pasture requires planning. Livestock tend to graze most heavily in areas near livestock watering and salting facilities, in the more gently sloping areas, and in areas near roads and trails. Distant corners of pastures and steep areas may be undergrazed. Poor grazing distribution can result from too few watering facilities or from poorly distributed watering and salting facilities, shade, and supplemental feed. A concentration of livestock results in severe overuse of that area while other areas are left unused. Carefully locating fences and salting and watering facilities help to achieve a uniform distribution of grazing.

Fences help to distribute grazing in a more uniform pattern. Also, they can divide pastures into sections used in a planned grazing system and can isolate blowouts and reseeded areas from livestock. Cross fences should follow natural land features and range sites as much as possible. The potential stocking rates should be similar for all pastures. Generally, the smaller pastures are managed more efficiently than the larger pastures. This efficiency should be considered when the pasture size is determined.

Properly locating salting facilities is one of the easiest means of achieving a more uniform distribution of grazing in a pasture. The salting facilities should be located away from watering facilities. Salt can be easily moved to areas that are undergrazed and can be relocated at different times throughout the grazing season. In areas of soils on the Sands and Sandy range sites, relocating the salting station each time that salt is provided lessens the hazard of soil blowing.

Properly located watering facilities also can improve the distribution of grazing. In Cheyenne County, livestock water is often drawn from wells that are mainly pumped by windmills. Some dugouts are on the wetter range sites. Stockwater dams are mainly in the heavier textured soil associations. They provide livestock water where the drainage area provides adequate runoff. Watering facilities should be spaced at varying

distances, depending on the terrain. In rough or hilly areas, the distance between facilities should not be more than 0.5 mile. In the more level areas, it should be no more than 1.0 mile. If the distance is too far, the areas near water will be overgrazed.

Range management also is dependent on the kinds and classes of livestock grazing the pasture. Cattle, sheep, and horses have different grazing habits and nutritional needs. Grazing habits also differ among classes of cattle. Yearlings graze the steeper areas and will graze a pasture more uniformly than cows with calves. Their tendency to trail along fence lines can result in erosion. Cow-calf pairs graze more on the gentle slopes and tend to stay closer to watering facilities than yearlings. They are not so active as yearlings. Livestock distribution may be more of a problem in pastures stocked with cows and calves.

Planned Grazing Systems

Planned grazing systems are effective in achieving maximum forage production and livestock performance while controlling erosion. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. The rest period may be throughout the year or during all or part of the growing season. The same pasture is not grazed during the same period 2 years in a row. As a result, plant vigor, the plant community, and the range condition improve. Planned grazing systems often result in a uniform distribution of grazing and maintain maximum productivity over a period of years. They help to overcome the adverse effects of drought or other climatic conditions on the plants. Planned grazing systems must be adapted to the needs of the rancher. Fences, watering facilities, range sites, range condition, kinds or classes of livestock, and economic factors are used to determine the best system for a particular ranch. Planned grazing systems can eventually increase stocking rates. They also help to control the number of parasites and the likelihood of disease among cattle because the pastures are generally cleaner than those continually grazed.

Deferred Grazing

Deferred grazing allows the plants a prolonged rest period. If grazing is deferred throughout the growing season, the plant community can improve rapidly. The undisturbed grasses leave a mulch at the surface, thus increasing the rate of water infiltration and reducing the susceptibility of the soil to erosion. Deferred grazing allows the desirable species to mature, flower, and seed naturally.

The need for deferment is based on the range condition. To be beneficial, deferment should be for a

minimum of 3 months and should coincide with the food storage period of the desirable plants. This period varies, depending on the grass species. It generally is from August to October for warm-season grasses. On some sites a deferment of 3 months is all that is needed, while on other sites a deferment of two complete growing seasons may be needed. Following the period of deferment, the pastures can be grazed after the first significant frost in the fall or early in the spring.

Range Seeding

In some areas, such as formerly cultivated fields, abandoned farmsteads, and severely and continuously overgrazed sites, improved range management alone cannot restore a satisfactory cover of native vegetation. Range seeding may be needed in these areas.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, well adapted species of native grasses are selected for planting, the correct seeding methods are used, and careful management is applied after seeding. Range seeding is most successful when the seedbed is firm and has a cover of mulch. The cover of mulch helps keep the soil moist, lowers the temperature of the surface soil, and helps to control erosion. It can be provided by planting a temporary crop, such as sudangrass, millet, or sorghum. The grass can be seeded directly into the stubble the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On the sandier soils, the hazard of soil blowing can be controlled by preparing the seedbed and planting the seeds in narrow strips over a period of several years or planting the seeds with a range interseeder.

Seeding mixtures should consist of adapted native grasses that are normally on the site. Consequently, they vary according to the range sites. Using a grassland drill with depth bands ensures the proper placement of seeds at a uniform depth. A range interseeder should be used in areas of soils in the Sands and Sandy range sites and in areas that have a severe hazard of soil blowing when the soils are tilled during seedbed preparation.

Newly seeded areas should not be grazed until after the grass is established. Establishment may take 2 or 3 years, depending on the grass species, the range site, and the method of planting. Initial grazing of these areas should be light. Grazing in late fall and winter or early in spring helps to control weeds until the grass is established.

Additional information about appropriate grass mixtures, grassland drills, and planting times can be obtained from the local office of the Natural Resources Conservation Service.

Control of Blowouts

Blowouts form in areas of sandy soils where the vegetation has been removed either by tillage or by heavy grazing. Most blowouts are along livestock trails or in overgrazed areas. Large blowouts form in areas near wells, where livestock tend to concentrate. Smaller blowouts generally form along trails or fence lines. Drought increases the likelihood that blowouts will form.

Unless stabilized, blowouts are likely to become larger. The wind blows the bare sand to bordering areas, where the windblown sand smothers the vegetation. A planned grazing system can stabilize many blowouts in 4 or 5 years. A stable grade should be established on the steep banks around the edge of the blowout. Otherwise, the steep slopes cannot revegetate and will be a constant source of shifting sand. Locating wells and salting facilities away from the blowout helps to prevent concentration of livestock in the area.

In areas where a natural seed source is not available and on large blowouts, reseeding may be necessary. Fences are needed to keep livestock out of the blowout. The edges should be shaped to a suitable grade. If a fast-growing cover crop is planted in the spring, a suitable mixture of native grass seed can be drilled into the stubble from the crop. The cover crop helps to protect the surface from soil blowing and creates a good seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and worked into the sand. After the blowout is seeded, the mulch helps to prevent the damage caused by windblown sand while the grasses are becoming established. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Brush Control

Small soapweed, western snowberry, and sand sagebrush are the main brush species in Cheyenne County. These plants encroach on the land and reduce forage yields by shading out desirable grasses. Western snowberry grows mainly in areas of loess and in transitional areas between deposits of loess and deposits of sand. Small soapweed can be a problem in areas of soils in the Sands and Thin Loess range sites. It can be controlled by selective grazing. If it is grazed during the winter, it loses vigor and may be broken off below the root crown. Feeding cottonseed cake as a protein supplement increases the amount of small soapweed that cattle consume. Applications of approved herbicide have limited effectiveness.

Western snowberry and sand sagebrush are best controlled by applications of approved herbicide. Repeated applications may be needed during

successive years. Areas treated with herbicide should be deferred from grazing to allow adequate recovery of grasses. Recommendations of herbicides are available from the local office of the Natural Resources Conservation Service or from the county extension agent.

Management of Native Hayland

A very limited acreage of rangeland in Cheyenne County is used for the production of native hay. In most of these areas the soils have a seasonal high water table and are in the Wetland, Wet Subirrigated, and Subirrigated range sites. Hay is harvested in a few upland or valley areas that generally are used for grazing. These areas generally are in the Sandy Lowland, Sandy, or Sands range sites.

Proper management can maintain or improve the production of hay. Timely mowing is needed to maintain strong plant vigor and a healthy stand. If the pastures are not mowed during the period between the boot stage, which is just before the emergence of the seed heads, and seed maturity, the plant roots can store more carbohydrates. A mowing height of 3 inches or more helps to maintain plant vigor. Meadows can be moderately grazed without damage after the first frost in the fall.

Meadows should not be grazed or harvested for hay when the soil is wet or the water table is within a depth of 6 inches. Grazing or using heavy machinery during these periods results in the formation of small bogs, ruts, or mounds, which can hinder mowing in later years. After the ground is frozen, livestock can graze without damaging the meadows. Livestock should be removed in the spring before the ground thaws and the soil becomes wet.

If the drier areas are used for hay, the optimum time for mowing is just before the dominant grasses reach the boot stage. Mowing should be regulated so that desirable grasses remain vigorous and healthy. Early mowing allows the plants enough time to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply.

Technical assistance in managing range and hayland can be obtained from the local office of the Natural Resources Conservation Service.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Natural Resources Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have been planted at various times on most farmsteads and ranch headquarters in Cheyenne County (fig. 16). Siberian elm and eastern redcedar are the predominant species. Other species include green ash, honeylocust,



Figure 16.—Windbreaks protect farmsteads, such as this one on Keith loam, 1 to 3 percent slopes, from severe winds.

hackberry, boxelder, Russian-olive, ponderosa pine, blue spruce, honeysuckle, lilac, Siberian peashrub, cotoneaster, and common chokecherry. Eastern cottonwood also is common on farmsteads in the Las-Glenberg-McCook association.

On many farmsteads, Siberian elm is the predominant species. Supplemental plantings of evergreen trees and shrubs are needed to provide high-quality protection from the wind in these areas. Planting trees and shrubs is a continual process because short-lived trees, such as Siberian elm, pass maturity and deteriorate; some trees are destroyed by insects,

diseases, or storms; and new plantings are needed on expanding ranches.

Very few field windbreaks and shelterbelts are in the county. A few trees remain, however, from the Timber Claim Act of 1873. These trees consist of blocks of boxelder or green ash.

The species of trees and shrubs grown as windbreaks should be those that are suited to the soils on the selected site. Permeability, available water capacity, fertility, soil depth, and soil texture greatly affect the growth rate of trees and shrubs. Selecting suitable species is the first step toward ensuring

survival and a maximum growth rate.

Trees and shrubs are difficult to establish in the county because of a limited supply of moisture. Proper site preparation before planting and control of competing vegetation after planting are the major management objectives when establishing windbreaks. Cover crops may be needed to protect new plants from hot winds and windblown soil. Supplemental watering using drip irrigation systems or other irrigation systems can provide the moisture needed during establishment.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service, the Cooperative Extension Service, the South Platte Natural Resources District, or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 10 can be supplemented by

other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or sand and gravel should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones on the surface.

Wildlife Habitat

Robert O. Koerner, biologist, Natural Resources Conservation Service, helped prepare this section.

Wildlife habitat in Cheyenne County varies, depending on the soil, topography, vegetation, slope, and drainage pattern. The following paragraphs describe the kinds of wildlife habitat in the associations described under the heading "General Soil Map Units."

The Bayard-Bridget-Duroc association has nearly level to gently sloping cropland. This association is suitable habitat for ring-necked pheasants because of the available food in the cropland and the water and cover along Lodgepole Creek.

The Las-Glenberg-McCook association is adjacent to Lodgepole Creek and offers a diversity of cover types. Woody species, such as willow and cottonwood, are adjacent to the creek because of the high water table. Other woody species, such as elm, boxelder, hackberry,

terrace native plum, chokecherry, and golden currant, are on the higher part of the stream terrace.

Parts of the association support native grass species, such as big bluestem, little bluestem, sideoats grama, blue grama, and western wheatgrass. Introduced grasses are brome grass, intermediate wheatgrass, and alfalfa. Crops include corn and wheat. This diversity of plants provides habitat for wildlife species, such as ring-necked pheasants, deer, songbirds, mink, muskrat, weasel, and beaver.

The other areas of cropland south of Lodgepole Creek are in the Kuma-Keith-Duroc and Alliance-Duroc-Kuma associations.

Some inclusions of the Lodgepole soil provide wetland habitat for shorebirds and waterfowl. Trees and shrubs are mainly around farmsteads. Additional field windbreaks can protect fields from soil blowing and water erosion and provide benefits to wildlife. The Kuma-Keith-Duroc and Alliance-Duroc-Kuma associations support substantial populations of antelope during years when the weather is favorable to their survival. Cottontail rabbits are scarce because of the lack of woody vegetation for winter and escape cover.

The Alliance-Duroc-Kuma, Kuma-Keith-Duroc, Rosebud-Sidney-Canyon, Altvan-Satanta-Johnstown, and Jayem-Duroc-Keith associations are predominantly cropland with varying slopes. Wheat and fallow is the predominant crop rotation, along with irrigated corn in areas where water is available. Trees and shrubs are generally lacking, except in pockets where additional moisture is available or in areas around farmsteads where they are planted. To increase the potential habitat for ring-necked pheasants and deer, more field windbreaks should be planted to eastern redcedar, Rocky Mountain juniper, ponderosa pine, Austrian pine, and Siberian elm. Planting these species also helps to control soil blowing and water erosion. Contour strip cropping can also add diversity and increase the edge effect for wildlife.

The Canyon-Bayard-Rosebud, Dix-Altvan, Mitchell-Epping-Rock outcrop, Alliance-Canyon-Sidney, and Busher-Tassel associations are predominantly rangeland and wildlife habitat. Native grass species include little bluestem, sideoats grama, needleandthread, hairy grama, western wheatgrass, and threadleaf sedge. Moderate populations of antelope are in the northern part of the county in the Canyon-Bayard-Rosebud and Busher-Tassel associations. Antelope are in a habitat that has rough grassland terrain adjacent to areas of cropland. A small population of deer is throughout the county. The greatest concentration of deer is in the Bayard-Bridget-Duroc and Las-Glenberg-McCook associations. A small population of mourning doves is throughout the county.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, smooth brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally

established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are boxelder, honeylocust, hackberry, and Siberian elm. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, common chokecherry, and American plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, eastern redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, Amur honeysuckle, skunkbush sumac, lilac, and Peking cotoneaster.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope. Examples of wetland plants are smartweed, saltgrass, prairie cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include pheasant, meadowlark, field sparrow, and cottontail rabbit.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and mink.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sharptail grouse, meadowlark, and lark bunting.

Native Woodland

Keith A. Ticknor, forester, Natural Resources Conservation Service, helped prepare this section.

Native woody vegetation in Cheyenne County is on bottom land in areas of the Las-Glenberg-McCook association and on the steep uplands in areas of the Canyon-Bayard-Rosebud and Busher-Tassel associations. The woodland does not have commercial value because the acreage is small and concentrations are not large enough. However, the local use of woodland is an important resource.

Eastern cottonwood, or plains cottonwood, and peachleaf willow are the predominant species in areas of bottom land along the channel. Other species include Siberian elm, American plum, common chokecherry, boxelder, sandbar willow, and golden currant.

Ponderosa pine is scattered on the steep slopes in areas of the Busher-Tassel association. Also, some ponderosa pine grows in areas of rock outcrop in the Canyon-Bayard-Rosebud association near the Buffalo Bend area. Skunkbush sumac, golden currant, and western snowberry (white buckbrush) are species associated with ponderosa pine.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations.

For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included in the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings

with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock; sand and gravel content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Bedrock interferes with installation. Cutbanks caving in is a hazard in areas of sandy soils.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if

slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, and flooding.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope and bedrock can cause construction problems, and sand and gravel can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a seasonal high water table, slope, and flooding affect both types of landfill. Texture, stones, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used

to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by depth to bedrock, amount of rock fragments, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or bedrock between depths of 40 to 60 inches. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, bedrock shallower than 40 inches, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Acidity and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are

naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow (fig. 17). In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a

depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or sand and gravel or salts. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, amount of rock fragments, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control water erosion and conserve moisture by intercepting runoff. Slope, wetness, sand and gravel content, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

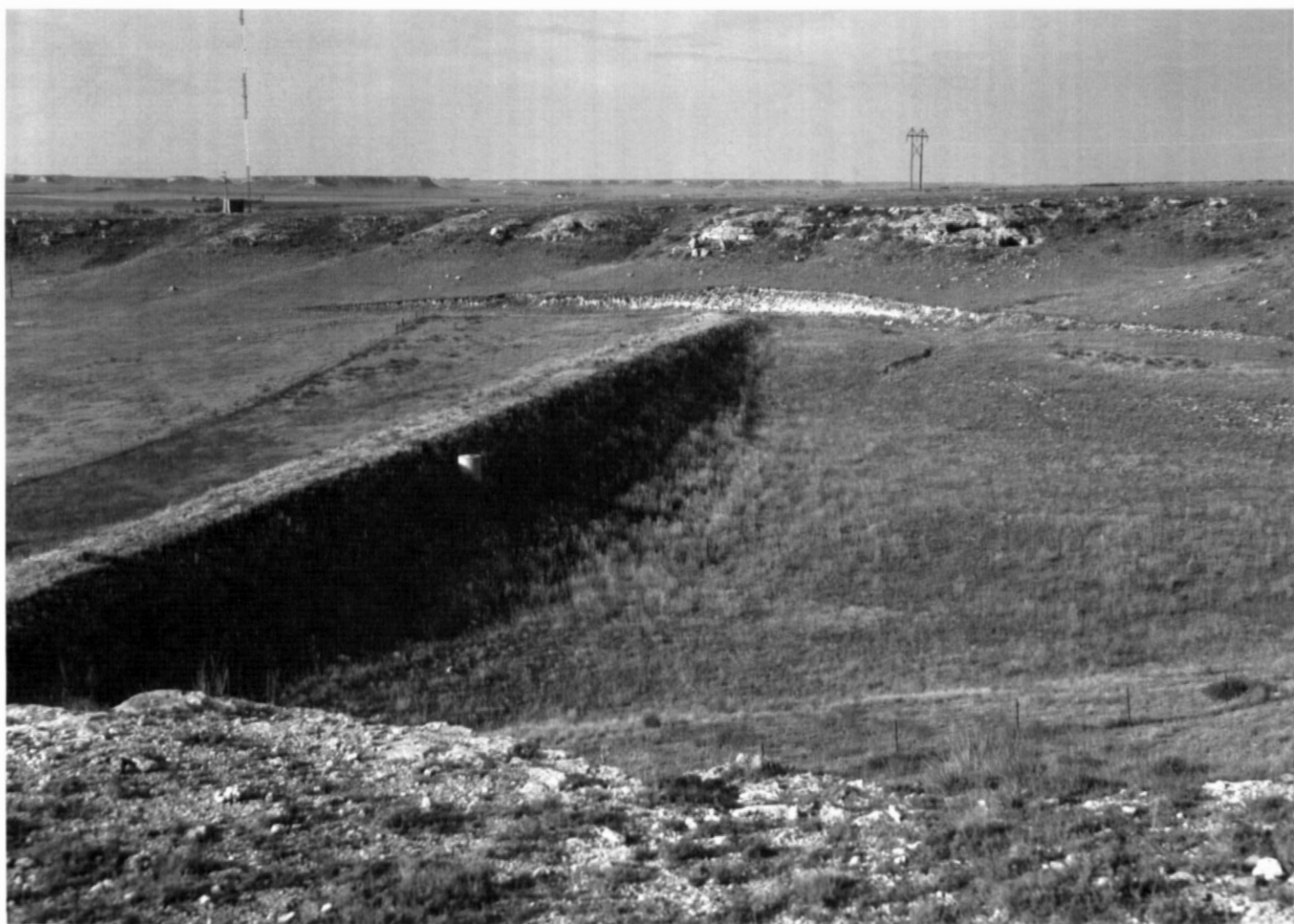


Figure 17.—Earthen dams protect lower lying areas from flooding on Bayard fine sandy loam, 3 to 6 percent slopes.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters

in diameter (fig. 18). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. In Nebraska the group index numbers range from -4 for the best subgrade material to 32 for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-

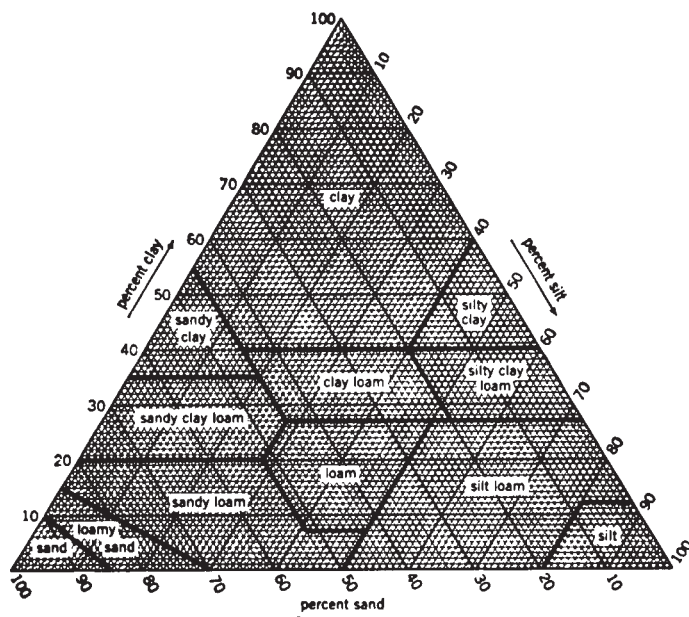


Figure 18.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $\frac{1}{3}$ -bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at

25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soil to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops.

They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

- 4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are

assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information about flooding is based on evidence

in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or

weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Specific gravity—T 100 (AASHTO). The group index number that is part of the AASHTO classification is computed by using the Nebraska Modified System.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (5). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning ustic moisture regime, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning presence of an argillic horizon, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup receives less moisture than typifies the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (6). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (5). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alliance Series

The Alliance series consists of deep, well drained, moderately permeable soils on uplands (fig. 19). They

formed in loess that is underlain by weakly cemented, fine grained, limy sandstone. Slopes range from 0 to 6 percent.

Alliance soils are commonly adjacent to Altvan, Duroc, Goshen, Keith, and Rosebud soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are on upland side slopes. Duroc and Goshen soils are pachic. They are in upland swales. Also, Duroc soils do not have an argillic horizon. Keith soils are deep to weakly cemented, fine grained, limy sandstone and are in landscape positions similar to those of the Alliance soils. Rosebud soils contain more sand and less silt in the control section than the Alliance soils. They are moderately deep to weakly cemented, fine grained, limy sandstone bedrock and are in landscape positions similar to those of the Alliance soils.

Typical pedon of Alliance loam, 1 to 3 percent slopes, 1,600 feet south and 100 feet west of the northeast corner of sec. 35, T. 15 N., R. 48 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—6 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; few thin clay films on faces of peds; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt2—15 to 21 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

BC—21 to 29 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; gradual smooth boundary.

C—29 to 52 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

Cr—52 to 60 inches; very pale brown (10YR 7/3), weakly cemented, fine grained, limy sandstone bedrock, pale brown (10YR 6/3) moist; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 35 inches. The depth to free carbonates ranges from 16 to

35 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to the Cr horizon ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but the range includes very fine sandy loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is typically silty clay loam and silt loam, but the range includes loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes very fine sandy loam, fine sandy loam, and loam. The Cr horizon has value of 7 or 8 (6 or 7 moist) and chroma of 2 to 4.

Altvan Series

The Altvan series consists of very deep, well drained soils that have gravelly sand at a depth of 20 to 40 inches (fig. 20). Permeability is moderate in the solum and very rapid in the 2C horizon. These soils formed in loamy sediments on uplands and stream terraces. Slopes range from 1 to 9 percent.

Altvan soils are commonly adjacent to Alliance, Dix, Johnstown, Rosebud, and Satanta soils. Alliance soils have a fine-silty control section and have weakly cemented, fine grained, limy sandstone bedrock below a depth of 40 inches. They are in landscape positions on uplands that are similar to those of the Altvan soils. Dix soils have very gravelly sand at a depth of 10 to 20 inches. They are on ridgetops and stream terraces. Johnstown soils are pachic. They have a buried horizon and have gravelly sand at a depth of 40 to 60 inches. They are on the less sloping landscapes. Rosebud soils are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Altvan soils. Satanta soils have gravelly loamy sand below a depth of 40 inches. They are in landscape positions similar to those of the Altvan soils.

Typical pedon of Altvan loam, 1 to 3 percent slopes, 2,240 feet south and 130 feet west of the northeast corner of sec. 32, T. 17 N., R. 48 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

AB—7 to 11 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt1—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium

subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt2—17 to 21 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

BC—21 to 30 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; soft, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—30 to 34 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

2C2—34 to 40 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose; about 20 percent gravel, by volume; violent effervescence; mildly alkaline; abrupt smooth boundary.

2C3—40 to 60 inches; pink (7.5YR 7/4) gravelly sand, light brown (7.5YR 6/4) moist; single grain; loose; about 25 percent gravel, by volume; very slight effervescence; mildly alkaline.

The thickness of the solum ranges from 16 to 38 inches. The depth to free carbonates ranges from 16 to 38 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to gravelly sand ranges from 20 to 40 inches. The solum contains 0 to 15 percent gravel.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bt horizon has value of 4 to 6 and chroma of 2 or 3. It is typically clay loam, but the range includes loam and sandy clay loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes loam and silt loam. The 2C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is typically gravelly sand, but the range includes gravelly coarse sand, sand, and coarse sand.

Bankard Series

The Bankard series consists of very deep, somewhat excessively drained, rapidly permeable soils on flood plains. The soils formed in stratified sandy, calcareous alluvium. Slopes range from 0 to 3 percent.

Bankard soils are commonly adjacent to Bayard, Bridget, Dwyer, and Glenberg soils. Bayard and Bridget soils have a mollic epipedon. They are not stratified and have finer textured material than the Bankard soils. They are on the more sloping, higher parts of the landscape. Dwyer soils are not stratified and are more

uniformly textured. They are on the steeper, higher, dune-like formations adjacent to the Bankard soils. Glenberg soils have finer textured material than the Bankard soils. They are in landscape positions similar to those of the Bankard soils.

Typical pedon of Bankard loamy sand, 0 to 2 percent slopes, 450 feet north and 200 feet west of the southeast corner of sec. 29, T. 14 N., R. 52 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—6 to 60 inches; stratified brown (10YR 5/3), grayish brown (10YR 5/2), and pale brown (10YR 6/3) fine sand, loamy sand, loamy very fine sand, and gravelly sand, brown (10YR 4/3) and dark grayish brown (10YR 4/2) moist; single grain; soft or loose, very friable or loose; strongly effervescent increasing to violently effervescent with depth; moderately alkaline.

The thickness of the solum ranges from 4 to 8 inches. Free carbonates are typically at the surface, but some pedons are noncalcareous in the upper part of the solum.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It typically is loamy sand, but the range includes loamy fine sand. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. Typically, it consists of strata of fine sand, loamy very fine sand, loamy sand, and gravelly sand. Some C horizons have strata of loamy fine sand, coarse sand, gravelly coarse sand, and sand.

Bayard Series

The Bayard series consists of very deep, well drained, moderately rapidly permeable soils on foot slopes, alluvial fans, and stream terraces. The soils formed in colluvial and alluvial sediments that weathered from weakly cemented, fine grained, limy sandstone. Slopes range from 0 to 20 percent.

Bayard soils are commonly adjacent to Bankard, Bridget, Canyon, and Glenberg soils. Bankard soils do not have a mollic epipedon. They are stratified and have coarser textured material than the Bayard soils. They are on the lower part of the landscape. Bridget soils have finer textured material than the Bayard soils. They are in landscape positions similar to those of the Bayard soils. Canyon soils have weakly cemented, fine grained, limy sandstone bedrock at shallow depths. They are on the higher part of the landscape. Glenberg soils do not have a mollic epipedon and are stratified.

They are on the lower part of the landscape.

Typical pedon of Bayard fine sandy loam, 3 to 6 percent slopes, 150 feet south and 100 feet west of the northeast corner of sec. 12, T. 13 N., R. 52 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A2—8 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

AC—12 to 22 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C1—22 to 30 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—30 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes sandy loam and very fine sandy loam. Reaction is neutral or mildly alkaline. The AC horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes sandy loam and very fine sandy loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is typically fine sandy loam or very fine sandy loam. In some pedons loamy fine sand is below a depth of 30 inches.

Bridget Series

The Bridget series consists of very deep, well drained, moderately permeable soils on foot slopes, alluvial fans, and stream terraces. The soils formed in loamy, calcareous, colluvial and alluvial sediments. Slopes range from 0 to 9 percent.

Bridget soils are commonly adjacent to Bankard, Bayard, Glenberg, and Mitchell soils. Bankard soils are occasionally flooded or frequently flooded. They have

coarser textured material throughout the profile than the Bridget soils and are on flood plains. Bayard soils have coarser textured material than the Bridget soils. They are in landscape positions similar to those of the Bridget soils. Glenberg soils have coarser textured material than the Bridget soils and are stratified. They are on flood plains. Mitchell soils do not have a mollic epipedon. They are on the higher part of the landscape.

Typical pedon of Bridget very fine sandy loam, 1 to 3 percent slopes, 1,000 feet north and 200 feet west of the southeast corner of sec. 12, T. 13 N., R. 51 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—5 to 13 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—13 to 19 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C—19 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 7 to 30 inches. The depth to free carbonates ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has chroma of 2 or 3. It is typically very fine sandy loam, but the range includes silt loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 to 4. It is typically very fine sandy loam or silt loam.

Busher Series

The Busher series consists of deep, well drained, moderately rapidly permeable soils on uplands. They formed in material weathered from weakly cemented, fine grained sandstone. Slopes range from 3 to 30 percent.

Busher soils are commonly adjacent to Dix, Duroc, Jayem, and Tassel soils and areas of Rock outcrop. Dix soils have very gravelly sand at a depth of 10 to 20 inches. They are on uplands in landscape positions similar to those of the Busher soils and on small knobs

at the higher elevations. Duroc soils have a dark surface soil that is more than 20 inches thick and have finer textured material than the Busher soils. They are in upland swales and on side slopes near drainageways. Jayem soils do not have free carbonates within a depth of 40 inches and do not have weakly cemented, fine grained sandstone bedrock within a depth of 60 inches. They are typically on the less steep part of the landscape. Tassel soils are shallow to sandstone and are on the steeper side slopes and narrow ridgetops. Areas of Rock outcrop consist of bare sandstone and are on narrow ridgetops and on sharp slope breaks.

Typical pedon of Busher fine sandy loam, in an area of Busher-Tassel complex, 3 to 9 percent slopes, 300 feet east and 200 feet south of the northwest corner of sec. 21, T. 17 N., R. 48 W.

- Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
- A1—6 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.
- A2—10 to 19 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; gradual wavy boundary.
- Bw—19 to 31 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; strong effervescence; mildly alkaline; gradual wavy boundary.
- C1—31 to 37 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.
- C2—37 to 45 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.
- Cr—45 to 60 inches; very pale brown (10YR 7/3) weakly cemented, fine grained sandstone bedrock, brown (10YR 5/3) moist; violent effervescence.

The thickness of the solum ranges from 15 to 40 inches. The depth to free carbonates ranges from 18 to 48 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Weakly cemented, fine grained sandstone bedrock is at a depth of 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). The

Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes loamy very fine sand and very fine sandy loam. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. It is typically fine sandy loam and loamy very fine sand, but the range includes very fine sandy loam.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous material weathered from weakly cemented, fine grained, limy sandstone. Slopes range from 3 to 45 percent.

Canyon soils are commonly adjacent to Alliance, Bayard, Rosebud, and Sidney soils and areas of Rock outcrop. Alliance soils have an argillic horizon and are deep to weakly cemented, fine grained, limy sandstone bedrock. They are in the less sloping areas. Bayard soils do not have weakly cemented, fine grained, limy sandstone bedrock within a depth of 60 inches. They are on foot slopes. Rosebud soils are moderately deep and have an argillic horizon. They are on the higher part of the landscape. Sidney soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. They are on the lower side slopes. Areas of Rock outcrop consist of sandstone and are on narrow ridgetops and on sharp slope breaks.

Typical pedon of Canyon fine sandy loam, 6 to 30 percent slopes (fig. 21), 2,050 feet east and 150 feet south of the northwest corner of sec. 19, T. 14 N., R. 51 W.

- A1—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.
- A2—3 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; violent effervescence; mildly alkaline; clear smooth boundary.
- C—6 to 11 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; massive; about 18 percent gravel, by volume; violent effervescence; moderately alkaline; abrupt smooth boundary.
- Cr—11 to 60 inches; white (10YR 8/2) and light gray (10YR 7/2), weakly cemented, fine grained, limy sandstone bedrock, very pale brown (10YR 7/3) and pale brown (10YR 6/3) moist; violent effervescence.

The thickness of the solum is typically 6 inches but ranges up to 12 inches. The depth to free carbonates

ranges from 0 to 6 inches. The depth to weakly cemented, fine grained, limy sandstone bedrock ranges from 6 to 20 inches. The content of coarse fragments ranges from 0 to 25 percent, by volume, in the C horizon.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes very fine sandy loam, loam, and gravelly loam. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 to 4. It is typically gravelly loam, but the range includes very fine sandy loam and loam.

Creighton Series

The Creighton series consists of very deep, well drained, moderately permeable soils on uplands. The soils formed in calcareous eolian material. Slopes range from 1 to 6 percent.

Creighton soils are commonly adjacent to Alliance, Busher, Duroc, Jayem, and Keith soils. Alliance soils have finer textured material than the Creighton soils. They have an argillic horizon and have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Creighton soils. Busher soils have weakly cemented, fine grained sandstone bedrock at a depth of 40 to 60 inches. They are on the steeper side slopes. Duroc soils have finer textured material than the Creighton soils and are pachic. They are in upland swales and near drainageways. Jayem soils have slightly coarser textured material than the Creighton soils and are free of carbonates at a depth of more than 20 inches. They are in landscape positions similar to those of the Creighton soils. Keith soils have finer textured material than the Creighton soils and have an argillic horizon. They are in landscape positions similar to those of the Creighton soils.

Typical pedon of Creighton very fine sandy loam, 3 to 6 percent slopes, 2,550 feet east and 250 feet south of the northwest corner of sec. 22, T. 17 N., R. 48 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—5 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.

Bw1—10 to 19 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

Bw2—19 to 23 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

Bk—23 to 30 inches; very pale brown (10YR 7/3) and pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; soft, very friable; common soft masses and threads of lime; violent effervescence; mildly alkaline; gradual smooth boundary.

C—30 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 40 inches. The depth to free carbonates ranges from 6 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches.

The A horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically very fine sandy loam, but the range includes loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically very fine sandy loam, but the range includes loam.

Dix Series

The Dix series consists of very deep, excessively drained soils that have very gravelly sand at a depth of 10 to 20 inches. They are on uplands and stream terraces. Permeability is rapid in the solum and very rapid in the underlying material. These soils formed in loamy, sandy, and gravelly sediments. Slopes range from 3 to 50 percent.

Dix soils are commonly adjacent to Altvan, Bankard, Canyon, Rosebud, and Tassel soils. Altvan soils have an argillic horizon and have gravelly sand at a depth of 20 to 40 inches. They are on the less sloping part of the landscape. Bankard soils are stratified and calcareous. They are on flood plains. Canyon and Tassel soils are calcareous and shallow to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Dix soils. Rosebud soils have finer textured material than the Dix soils. They have an argillic horizon and are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are on the higher landscapes.

Typical pedon of Dix gravelly loam, 3 to 11 percent slopes (fig. 22), 2,575 feet south and 200 feet east of the northwest corner of sec. 29, T. 14 N., R. 46 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2)

moist; weak fine granular structure; soft, very friable; about 18 percent gravel, by volume; neutral; clear smooth boundary.

AC—6 to 11 inches; brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable; about 22 percent gravel, by volume; neutral; gradual smooth boundary.

C1—11 to 19 inches; brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 4/3) moist; single grain; loose; about 25 percent gravel, by volume; neutral; gradual smooth boundary.

C2—19 to 60 inches; pale brown (10YR 6/3) very gravelly sand, brown (10YR 5/3) moist; single grain; loose; about 40 percent gravel, by volume; neutral.

These soils generally do not have free carbonates, but in some pedons the pebbles have a coating of lime. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to very gravelly sandy material ranges from 10 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically gravelly loam, but the range includes sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 4. It is typically gravelly loamy coarse sand and very gravelly sand, but the range includes gravelly coarse sand and very gravelly coarse sand.

The Dix soils in Altvan-Dix complex, 3 to 9 percent slopes, have a particle-size control section that contains less gravel than is defined as the range for the series. This difference, however, does not affect the use and management of the soils.

Duroc Series

The Duroc series consists of very deep, well drained, moderately permeable soils on slightly concave parts of alluvial fans and side slopes near drainageways and in swales on stream terraces and uplands. They formed in alluvial sediments and eolian material. Slopes range from 0 to 3 percent.

Duroc soils are commonly adjacent to Alliance, Goshen, Keith, Kuma, and Lodgepole soils. Alliance and Keith soils are not pachic and have a well developed subsoil. They are higher on the landscape than the Duroc soils. Also, Alliance soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. Goshen soils are pachic and have a well developed subsoil that contains more clay than that of the Duroc soils. They are in swales. Kuma soils are pachic and have a polygenetic solum. They are in landscape positions that are similar to those of the Duroc soils. Lodgepole soils have more clay in the subsoil than the Duroc soils. They are in depressions.

Typical pedon of Duroc loam, 0 to 1 percent slopes (fig. 23), 570 feet south and 220 feet east of the northwest corner of sec. 13, T. 16 N., R. 49 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—6 to 19 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) exterior and very dark brown (10YR 2/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

Bw—19 to 31 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; moderately alkaline; clear wavy boundary.

Bk—31 to 41 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; common threads of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

BC—41 to 55 inches; about 85 percent brown (10YR 5/3) and 15 percent dark grayish brown (10YR 4/2) silt loam, 85 percent brown and dark brown (10YR 4/3) and 15 percent very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, friable; strong effervescence; moderately alkaline; gradual wavy boundary.

C—55 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; common very coarse rounded soft dark masses; strong effervescence; strongly alkaline.

The depth to free carbonates ranges from 10 to 36 inches. The thickness of the mollic epipedon ranges from 20 to 50 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but the range includes silt loam. The Bw horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 to 6. It is typically loam and silt loam. Some pedons do not have a Bw horizon. The C horizon is typically loam, but the range includes silt loam.

Dwyer Series

The Dwyer series consists of very deep, excessively drained, rapidly permeable soils on dune-like formations

on or near alluvial terraces. They formed in eolian sand. Slopes range from 9 to 17 percent.

Dwyer soils are commonly adjacent to Bankard, Bayard, Bridget, and Glenberg soils. Bankard and Glenberg soils are stratified. They are on flood plains. Bankard soils contain coarse sand and gravel. Bayard and Bridget soils have finer textured material than the Dwyer soils. They are on terraces and foot slopes.

Typical pedon of Dwyer loamy fine sand, 9 to 17 percent slopes, 1,200 feet north and 150 feet east of the southwest corner of sec. 29, T. 14 N., R. 52 W.

- A—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.
- C1—4 to 15 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.
- C2—15 to 32 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.
- C3—32 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; loose; violent effervescence; moderately alkaline.

Typically, these soils are calcareous to the surface. The control section is loamy fine sand, loamy sand, or fine sand.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. The C horizon has value of 4 or 5 moist.

Epping Series

The Epping series consists of shallow, well drained, moderately permeable soils on uplands and foot slopes. They formed in loamy material weathered from siltstone that contains material from volcanic ash. Slopes range from 3 to 45 percent.

Epping soils are commonly adjacent to Bridget and Mitchell soils and areas of siltstone Rock outcrop. Bridget soils have a mollic epipedon. They are on the slightly lower foot slopes. Mitchell soils are very deep. They are on the lower foot slopes. Areas of siltstone Rock outcrop consist of bare rock. They are on the higher and steeper slope breaks.

Typical pedon of Epping loam, in an area of Epping-Mitchell complex, 3 to 20 percent slopes, 600 feet south and 150 feet west of the northeast corner of sec. 24, T. 13 N., R. 51 W.

- A1—0 to 1 inch; pale brown (10YR 6/3) loam, dark

grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

- A2—1 to 5 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C—5 to 13 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

- Cr—13 to 60 inches; very pale brown (10YR 7/3) siltstone bedrock; violent effervescence.

The depth to free carbonates ranges from 0 to 6 inches. The depth to siltstone bedrock ranges from 10 to 20 inches.

The A horizon has value of 5 or 6 (3 or 4 moist). It is typically loam, but the range includes silt loam. The C horizon has value of 6 to 8 (4 or 5 moist). It is typically loam, but the range includes silt loam.

Glenberg Series

The Glenberg series consists of very deep, well drained, moderately rapidly permeable soils on flood plains. The soils formed in stratified, calcareous alluvium derived from mixed sources. Slopes range from 0 to 2 percent.

The Glenberg soils in Cheyenne County are a taxadjunct to the Glenberg series because they are in a more humid climate than is definitive for the series. This difference, however, does not alter the use or behavior of these soils. In this survey area the Glenberg soils are coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Glenberg soils are commonly adjacent to Bankard, Bayard, Bridget, and Dwyer soils. The somewhat excessively drained Bankard soils have a control section that is coarser textured than that of the Glenberg soils. They are on landscape positions similar to those of the Glenberg soils. Bayard and Bridget soils have a mollic epipedon and are not stratified. They are on the higher part of the landscape. Dwyer soils are not stratified and are more uniformly textured. They are on the steeper, higher, dune-like formations on bottom land.

Typical pedon of Glenberg fine sandy loam, 0 to 2 percent slopes, 500 feet south and 150 feet west of the northeast corner of sec. 33, T. 14 N., R. 47 W.

- Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist;



Figure 19.—Profile of Alliance loam. Depth to soft bedrock ranges from 40 to 60 inches. Depth is marked in feet.

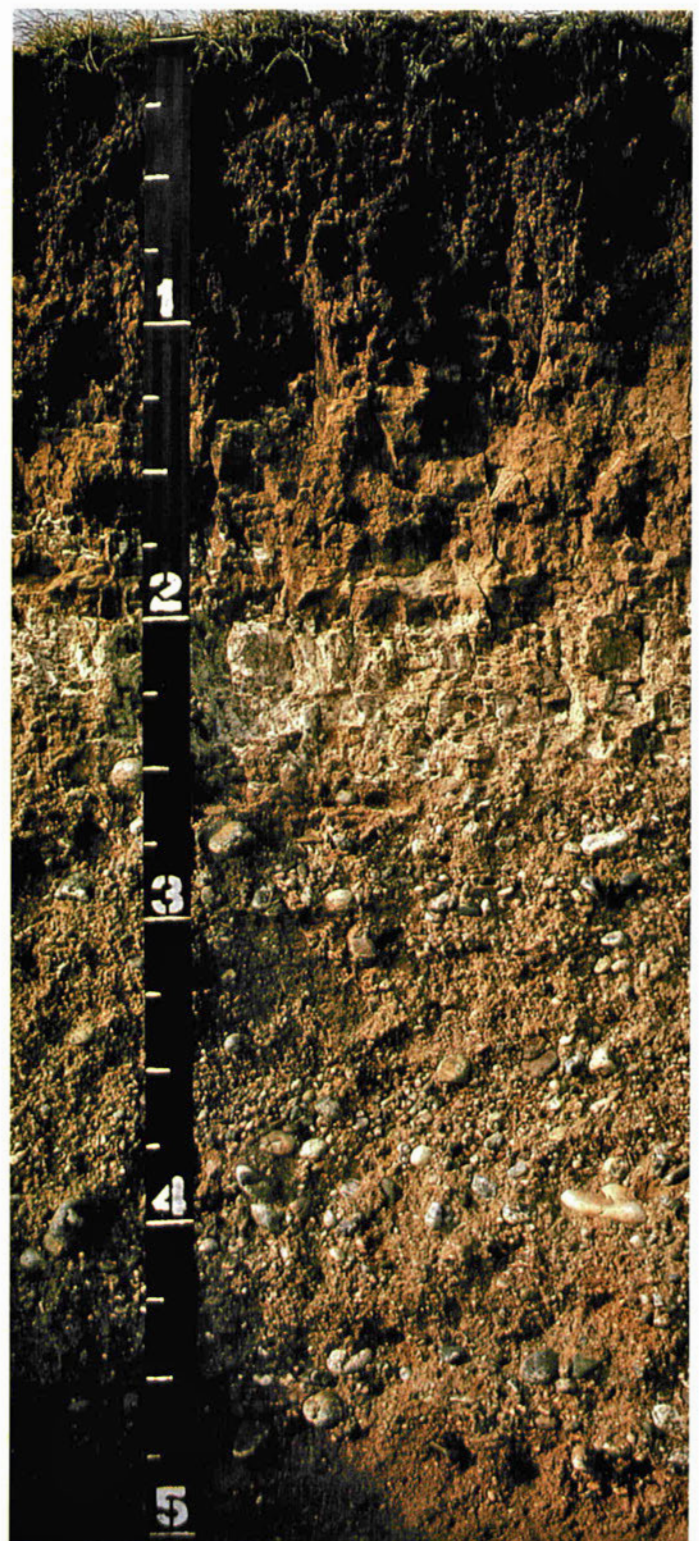


Figure 20.—Profile of Altvan loam. Depth to gravelly sand ranges from 20 to 40 inches. Depth is marked in feet.



Figure 21.—Profile of Canyon fine sandy loam. Depth to bedrock ranges from 6 to 20 inches. Depth is marked in feet.

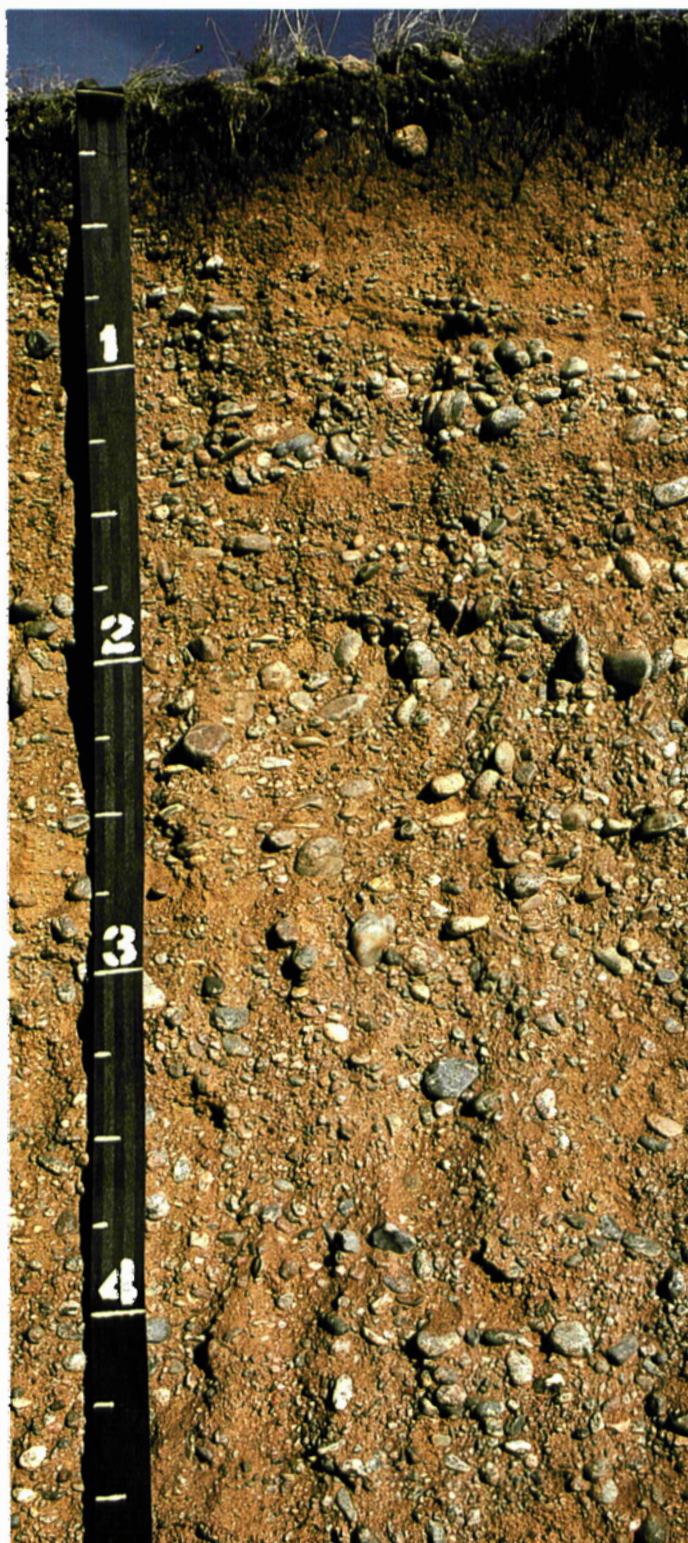


Figure 22.—Profile of Dix gravelly loam. Depth to very gravelly sand ranges from 10 to 20 inches. Depth is marked in feet.

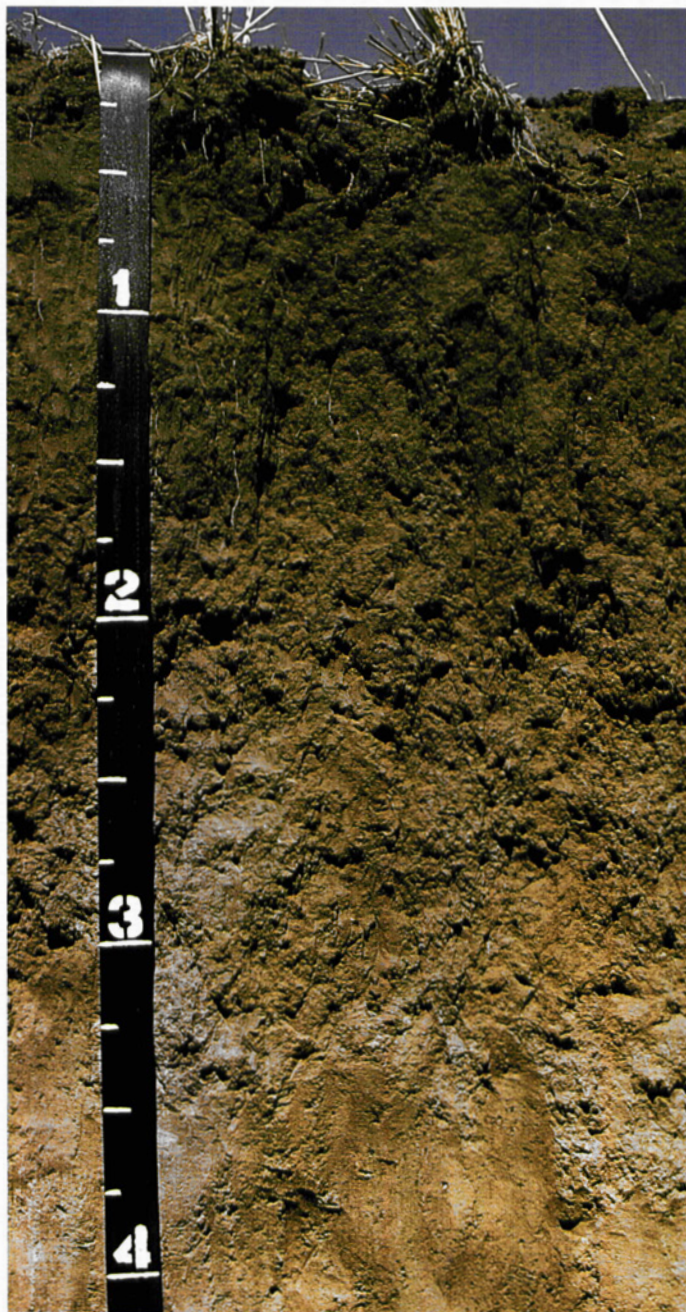


Figure 23.—Profile of Duroc loam. This soil is very deep and well drained and has a thick surface layer. Depth is marked in feet.



Figure 24.—Profile of Kuma loam. This soil is very deep and well drained and has a buried horizon. Depth is marked in feet.



Figure 25.—Profile of Mitchell very fine sandy loam. This soil has a thin surface layer. Depth is marked in feet.

weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C—6 to 60 inches; stratified light brownish gray (10YR 6/2), light gray (10YR 7/2), and grayish brown (2.5Y 5/2) fine sandy loam, loamy fine sand, very fine sandy loam, and silt loam, dark grayish brown (10YR 4/2 and 2.5Y 4/2), grayish brown (10YR 5/2), and very dark grayish brown (2.5Y 3/2) moist; massive; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 4 to 8 inches. Free carbonates are at the surface or leached to a depth of a few inches in some pedons.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is typically fine sandy loam, but the range includes very fine sandy loam and loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. Strata of darker colors are below a depth of 40 inches. It is typically fine sandy loam, loamy fine sand, and very fine sandy loam, but the range includes stratified loamy sand to clay loam.

Goshen Series

The Goshen series consists of very deep, well drained, moderately permeable soils in upland swales. These soils formed in silty alluvium derived from soils formed in loess. Slopes are 0 to 1 percent.

Goshen soils are commonly adjacent to Alliance, Duroc, Keith, and Sidney soils. Alliance, Keith, and Sidney soils are not pachic. They are higher on the landscape than the Goshen soils. Also, Alliance and Sidney soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. Duroc soils do not have a strongly developed subsoil. They have less clay and more silt in the control section than the Goshen soils. They are in landscape positions similar to those of the Goshen soils.

Typical pedon of Goshen silt loam, 0 to 1 percent slopes, 1,350 feet east and 250 feet north of the southwest corner of sec. 7, T. 12 N., R. 51 W.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

Ap2—4 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable;

neutral; clear smooth boundary.

Bt1—12 to 17 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt2—17 to 25 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt3—25 to 37 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; few thin clay films on faces of peds; neutral; gradual smooth boundary.

BC—37 to 44 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C—44 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 35 to 60 inches. The depth to free carbonates ranges from 34 to more than 60 inches. The mollic epipedon is 20 inches thick in places. It always extends into the B horizon.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes loam and fine sandy loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is typically silty clay loam, but the range includes loam and silt loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes loam and very fine sandy loam.

Jayem Series

The Jayem series consists of very deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in eolian material weathered from noncalcareous sandstone. Slopes range from 1 to 6 percent.

Jayem soils are commonly adjacent to Busher, Creighton, Duroc, Keith, and Valent soils. Busher soils have weakly cemented, fine grained sandstone bedrock at a depth of 40 to 60 inches. They are on the steeper slopes. Creighton soils have free carbonates within a depth of 40 inches. They are in landscape positions similar to those of the Jayem soils. Duroc soils have finer textured material than the Jayem soils and are pachic. They are in upland swales and along wide drainageways. Keith soils have an argillic horizon and

have finer textured material than the Jayem soils. They are in landscape positions similar to those of the Jayem soils. Valent soils do not have a mollic epipedon and contain slightly more sand than the Jayem soils. They are in the more sloping areas, generally at lower elevations.

Typical pedon of Jayem fine sandy loam, 3 to 6 percent slopes, 300 feet west and 200 feet south of the northeast corner of sec. 25, T. 16 N., R. 49 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—5 to 19 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

Bw—19 to 30 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

C1—30 to 54 inches; pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; neutral; gradual smooth boundary.

C2—54 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 40 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist). It is typically fine sandy loam, but the range includes loamy fine sand. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It typically is fine sandy loam, but the range includes very fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It typically is fine sandy loam, but the range includes loamy very fine sand and very fine sandy loam.

Johnstown Series

The Johnstown series consists of very deep, well drained soils on upland flats. Permeability is moderate in the solum and very rapid in the underlying material. These soils formed in loess and loamy sediments. They have a buried soil. Slopes are 0 to 1 percent.

Johnstown soils are commonly adjacent to Altvan, Duroc, Kuma, and Satanta soils. Altvan soils are on the more sloping landscapes and have gravelly sand at a depth of 20 to 40 inches. Duroc soils do not have an argillic horizon. They are in upland swales. Kuma soils do not have gravelly sand in the lower part of the

underlying material. They are in landscape positions similar to those of the Johnstown soils. Satanta soils are not pachic. They are in landscape positions similar to those of the Johnstown soils.

Typical pedon of Johnstown loam, 0 to 1 percent slopes, 1,350 feet west and 100 feet north of the southeast corner of sec. 13, T. 12 N., R. 51 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—5 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear smooth boundary.

Bt—9 to 14 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; abrupt smooth boundary.

Btb1—14 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Btb2—18 to 22 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Btb3—22 to 25 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bkb—25 to 46 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; common accumulations of carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

2C—46 to 60 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 4/3) moist; single grain; about 20 percent gravel, by volume; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 25 to 46 inches. The thickness of the mollic epipedon ranges from 20 to 44 inches. The thickness of the solum ranges from 36 to 55 inches.

The A horizon has value of 4 or 5 and chroma of 1 to 3. It is typically loam, but the range includes silt loam and fine sandy loam. The Bt horizon has value of 4 or 5 and chroma of 2 or 3. It is typically clay loam, but the range includes silty clay loam. The Btb horizon has value of 3 to 6 (2 to 5 moist) and chroma of 1 to 4. It is typically clay loam, but the range includes silty clay loam and clay loam. The 2C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically gravelly sand, but the range includes gravelly coarse sand.

Keith Series

The Keith series consists of very deep, well drained, moderately permeable soils on uplands. They formed in loess. Slopes range from 0 to 6 percent.

Keith soils are commonly adjacent to Alliance, Duroc, Kuma, Rosebud, and Ulysses soils. Alliance and Rosebud soils are less than 60 inches to weakly cemented, fine grained, limy sandstone bedrock. They are on landscape positions similar to those of the Keith soils. Duroc and Kuma soils are pachic. They are on the lower part of the landscape. Also, Duroc soils do not have an argillic horizon, and Kuma soils have a buried horizon. Ulysses soils do not have an argillic horizon and have carbonates nearer to the surface. They are on landscape positions similar to those of the Keith soils.

Typical pedon of Keith loam, 1 to 3 percent slopes, 550 feet west and 150 feet south of the northeast corner of sec. 35, T. 17 N., R. 47 W.

- Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; few thin clay films on faces of peds; neutral; abrupt smooth boundary.
- A—6 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak medium granular; slightly hard, very friable; few thin clay films on faces of peds; neutral; clear smooth boundary.
- Bt1—10 to 14 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.
- Bt2—14 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.
- BC—18 to 23 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular

blocky structure; hard, friable; neutral; gradual smooth boundary.

- C1—23 to 34 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.
- C2—34 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 48 inches. The depth to free carbonates ranges from 15 to 38 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes silty clay loam and loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 to 4. It is typically silt loam and very fine sandy loam, but the range includes loam.

Kuma Series

The Kuma series consists of very deep, well drained, moderately permeable soils on upland flats and drainageways. They formed in loess over a buried soil that also formed in loess. Slopes are 0 to 1 percent.

Kuma soils are commonly adjacent to Altvan, Duroc, Goshen, and Keith soils. All of the adjacent soils do not have a buried soil. Altvan soils are not pachic. They are on the more sloping landscapes. Also, they have gravelly sand at a depth of 20 to 40 inches. Duroc and Goshen soils are in upland swales. Also, Duroc soils do not have an argillic horizon. Keith soils are not pachic. They are higher on the landscape than the Kuma soils.

Typical pedon of Kuma loam, 0 to 1 percent slopes (fig. 24), 2,300 feet west and 275 feet south of the northeast corner of sec. 26, T. 16 N., R. 50 W.

- Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
- Bt—7 to 14 inches; brown and dark brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.
- Btb1—14 to 24 inches; dark grayish brown (10YR 4/2)

silt loam, black (10YR 2/1) exterior and very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btb2—24 to 32 inches; brown (10YR 5/3) silt loam, brown and dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; few thin clay films on faces of peds; common coarse cylindrical insect casts; moderately alkaline; clear wavy boundary.

Bkb—32 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak prismatic structure parting to weak medium subangular blocky; soft, very friable; threaded soft masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C1—42 to 56 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; common very coarse rounded soft dark masses; violent effervescence; strongly alkaline; gradual wavy boundary.

C2—56 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; strongly alkaline.

The depth to free carbonates ranges from 10 to 40 inches. The thickness of the mollic epipedon ranges from 20 to 50 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bt horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silty clay loam, but the range includes loam and silt loam. The buried B horizon has value of 4 to 6 (2 to 5 moist) and chroma of 1 to 3. It is typically silt loam, but the range includes silty clay loam, clay loam, and loam. The C horizon is typically silt loam and very fine sandy loam, but the range includes loam.

Las Series

The Las series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on flood plains. They formed in light colored, calcareous, loamy alluvium. Slopes are 0 to 1 percent.

Las soils are commonly adjacent to Bankard, Glenberg, Las Animas, and McCook soils. Bankard soils are somewhat excessively drained, and Glenberg soils are well drained. Both soils have coarser textured material than the Las soils and are in landscape positions similar to those of the Las soils. Las Animas

soils are poorly drained and are coarse-loamy. They are on the slightly lower landscapes. McCook soils are well drained and are coarse-silty. They are on the slightly higher landscapes.

Typical pedon of Las loam, 0 to 1 percent slopes, 500 feet north and 100 feet east of the southwest corner of sec. 30, T. 14 N., R. 47 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

A2—4 to 11 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate very fine angular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—11 to 19 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—19 to 26 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; very few fine faint brown (7.5YR 4/4) mottles; massive; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C3—26 to 33 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C4—33 to 46 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; soft accumulations of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C5—46 to 54 inches; light brownish gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) moist; few fine faint dark brown (7.5YR 4/4) mottles; massive; soft, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C6—54 to 60 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 5 to 15 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 moist, and chroma of 2 or 3. It is typically loam, but the range includes clay loam. Some pedons have an AC horizon. The C horizon has value of 5 to 7 and chroma of 2 or 3. It is typically loam, clay loam, sandy loam, and sandy clay loam that have thin strata of

sandy and clayey material. Some pedons have a 2C horizon below a depth of 40 inches.

Las Animas Series

The Las Animas series consists of very deep, poorly drained, moderately rapidly permeable soils on flood plains. They formed in thick, calcareous, stratified alluvial sediments derived from mixed sources. Slopes range from 0 to 2 percent.

Las Animas soils are commonly adjacent to Bankard, Glenberg, and Las soils. All of the adjacent soils are slightly higher on the landscape than the Las Animas soils. Bankard soils have more sand in the control section than the Las Animas soils. They are somewhat excessively drained. Glenberg soils are well drained. Las soils are somewhat poorly drained and are fine-loamy.

Typical pedon of Las Animas loam, 0 to 2 percent slopes, 1,850 feet east and 400 feet north of the southwest corner of sec. 32, T. 14 N., R. 46 W.

A—0 to 5 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; few fine faint dark yellowish brown (10YR 3/4) mottles; weak fine granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

ACg—5 to 11 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

Cg1—11 to 33 inches; stratified light gray (2.5Y 7/2) and light brownish gray (2.5Y 6/2) fine sandy loam and sandy loam, grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) moist; common fine faint yellowish brown (10YR 5/6) mottles; massive; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

Cg2—33 to 60 inches; stratified light brownish gray (2.5Y 6/2) and light gray (5Y 6/1) loamy fine sand and very fine sandy loam, dark grayish brown (2.5Y 4/2) and dark gray (5Y 4/1) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 4 to 16 inches. The depth to free carbonates ranges from 0 to 10 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 2.5Y or 10YR, value of 4 or 5 (2 or 3 moist) and chroma of 0 to 2. It is typically loam, but the range includes fine sandy loam, sandy

loam, and very fine sandy loam. The Cg horizon has hue of 5Y to 10YR. It is typically fine sandy loam, sandy loam, loamy fine sand, and very fine sandy loam, but the range includes strata of loamy sand to loam.

Lodgepole Series

The Lodgepole series consists of very deep, somewhat poorly drained, very slowly permeable soils in depressions on uplands. They formed in loess and loamy sediments. Slopes are 0 to 1 percent.

The Lodgepole soils in Cheyenne County are taxadjuncts to the Lodgepole series because they contain an albic horizon, which is not definitive of the series. This difference, however, does not alter the use or behavior of these soils. In this survey area the Lodgepole soils are fine, montmorillonitic, mesic Typic Argiaquolls.

Lodgepole soils are commonly adjacent to Alliance, Duroc, Goshen, Keith, and Kuma soils. The adjacent soils are well drained and have less clay in the control section than the Lodgepole soils. Also, Alliance and Keith soils are not pachic. Alliance soils have weakly cemented, fine grained, limy sandstone bedrock within a depth of 60 inches. Duroc and Goshen soils are in landscape positions similar to those of the Lodgepole soils. Alliance, Keith, and Kuma soils are on the higher part of the landscape.

Typical pedon of Lodgepole silt loam, 0 to 1 percent slopes, 1,800 feet west and 150 feet south of the northeast corner of sec. 26, T. 13 N., R. 53 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

A2—3 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

E—7 to 9 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure parting to weak fine subangular blocky; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

Bt1—9 to 17 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine angular blocky; hard, firm; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt2—17 to 33 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong medium angular blocky; very hard, very firm;

few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

BC—33 to 47 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; mildly alkaline; gradual smooth boundary.

C—47 to 58 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; few fine soft iron segregations; slight effervescence; mildly alkaline; gradual smooth boundary.

Cz—58 to 60 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 60 inches. The depth to free carbonates ranges from 24 to 60 inches. The mollic epipedon ranges from 20 to 41 inches in thickness.

The A horizon has value of 4 or 5 and chroma of 1 or 2. It is typically silt loam, but the range includes loam. The E horizon, if it occurs, has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. The Bt horizon has value of 2 or 3 moist and chroma of 1 to 3. It is typically silty clay and clay, but the range includes silty clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically silt loam, but the range includes fine sandy loam, sandy loam, and loam. In some pedons this horizon has weakly cemented, calcareous material below a depth of 40 inches.

McCook Series

The McCook series consists of very deep, well drained, moderately permeable soils on flood plains. They formed in weakly stratified, calcareous, loamy alluvium. Slopes are 0 to 1 percent.

McCook soils are commonly adjacent to Bankard, Bridget, Glenberg, and Las soils. Bankard and Glenberg soils have coarser textured material than the McCook soils. They do not have a mollic epipedon. Bankard soils are on the lower part of the landscape, and Glenberg soils are in landscape positions similar to those of the McCook soils. Bridget soils are not stratified. They are on the higher part of the landscape. Las soils are somewhat poorly drained. They have finer textured material in the control section than the McCook soils and are on the lower part of the landscape.

Typical pedon of McCook very fine sandy loam, 0 to 1 percent slopes, 900 feet south and 120 feet west of the northeast corner of sec. 33, T. 14 N., R. 48 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2)

moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—8 to 12 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—12 to 19 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—19 to 25 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C2—25 to 53 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; violent effervescence; moderately alkaline; gradual smooth boundary.

C3—53 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The thickness of the solum ranges from 16 to 33 inches.

The A horizon has value of 4 or 5 dry. It is typically very fine sandy loam, but the range includes fine sandy loam and loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is typically very fine sandy loam and fine sandy loam, but the range includes silt loam and loam. Some pedons have coarser textured material below a depth of 40 inches.

Mitchell Series

The Mitchell series consists of very deep, well drained, moderately permeable soils on foot slopes and valley side slopes. They formed in colluvial and alluvial sediments weathered from siltstone. Slopes range from 3 to 20 percent.

The Mitchell soils in Cheyenne County are taxadjuncts to the Mitchell series because they are in a more humid climate than is definitive for the series. This difference, however, does not alter the use or behavior of these soils. In this survey area the Mitchell soils are coarse-silty, mixed (calcareous), mesic Ustic Torriorthents.

Mitchell soils are commonly adjacent to Bayard, Bridget, and Epping soils. Bayard and Bridget soils have a mollic epipedon. They are on the lower foot

slopes. Also, Bayard soils have coarser textured material than the Mitchell soils. Epping soils have bedrock within a depth of 20 inches. They are on the higher foot slopes and on uplands.

Typical pedon of Mitchell very fine sandy loam, 6 to 9 percent slopes (fig. 25), 600 feet south and 200 feet west of the northeast corner of sec. 13, T. 13 N., R. 51 W.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

AC—5 to 17 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C1—17 to 44 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—44 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 7 to 24 inches. The depth to free carbonates ranges from 0 to 10 inches.

The A horizon has value of 5 or 6 and chroma of 2 or 3. It is typically very fine sandy loam, but the range includes silt loam, loam, or fine sandy loam. The AC and C horizons have value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. They are typically silt loam, but the range includes very fine sandy loam and loam.

Rosebud Series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous residuum of weakly cemented, fine grained, limy sandstone. Slopes range from 0 to 9 percent.

Rosebud soils are commonly adjacent to Alliance, Altvan, Canyon, and Sidney soils. The deep Alliance soils contain more silt and less sand in the control section than the Rosebud soils. They are in landscape positions similar to those of the Rosebud soils. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Rosebud soils. Canyon soils are shallow. They are on the steeper side slopes and ridgetops. Sidney soils are deep and do not have an argillic horizon. They are in landscape positions similar to those of the Rosebud soils.

Typical pedon of Rosebud loam, 1 to 3 percent slopes, 425 feet north and 75 feet west of the southeast corner of sec. 36, T. 14 N., R. 53 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; about 2 percent sandstone pebbles; mildly alkaline; abrupt smooth boundary.

Bt1—4 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; about 50 percent very dark brown (10YR 2/2) exterior coatings moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few thin clay films on faces of peds; about 2 percent sandstone gravel, by volume; mildly alkaline; gradual smooth boundary.

Bt2—7 to 15 inches; brown (10YR 5/3) loam, brown and dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few thin clay films on faces of peds; about 5 percent sandstone gravel, by volume; mildly alkaline; clear wavy boundary.

Bk1—15 to 20 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; about 5 percent sandstone pebbles; strong effervescence; mildly alkaline; gradual smooth boundary.

Bk2—20 to 30 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable; about 8 percent sandstone gravel, by volume; violent effervescence; moderately alkaline; clear wavy boundary.

2Cr1—30 to 50 inches; white (10YR 8/1) weathered sandstone bedrock, light gray (10YR 7/2) moist; massive; violent effervescence; moderately alkaline; gradual smooth boundary.

2Cr2—50 to 60 inches; white (10YR 8/1) weathered sandstone bedrock, light gray (2.5Y 7/2) moist; massive; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 34 inches. The depth to free carbonates ranges from 9 to 24 inches. The thickness of the mollic epipedon is typically 7 inches but ranges up to 20 inches. Depth to the Cr horizon ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and fine sandy loam. The Bt horizon has value of 4 to 6 dry. It is typically clay loam, but the range includes loam. The C horizon, if it occurs, has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is

typically loam, but the range includes sandy loam, sandy clay loam, and very fine sandy loam.

Satanta Series

The Satanta series consists of very deep, well drained soils on uplands and high stream terraces. Permeability is moderate in the solum and the upper part of the underlying material and rapid in the lower part of the underlying material. These soils formed in loamy eolian or alluvial sediments over gravelly loamy sand. Slopes range from 0 to 6 percent.

Satanta soils are commonly adjacent to Alliance, Altvan, Johnstown, and Keith soils. Alliance and Keith soils have a fine-silty control section. They are in landscape positions similar to those of the Satanta soils. Also, Alliance soils have weakly cemented, fine grained, limy sandstone bedrock at a depth of 40 to 60 inches. Altvan soils have gravelly sand at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Satanta soils. Johnstown soils have a mollic epipedon more than 20 inches thick and have a buried horizon. They are on broad uplands.

Typical pedon of Satanta loam, gravelly substratum, 1 to 3 percent slopes, 1,900 feet south and 250 feet east of the northwest corner of sec. 26, T. 13 N., R. 51 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—6 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

Bt1—10 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt2—14 to 18 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; gradual wavy boundary.

BCh—18 to 27 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable; about 3 percent gravel, by volume; violent effervescence; mildly alkaline; gradual smooth boundary.

C1—27 to 44 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; about 5 percent gravel, by volume; violent

effervescence; mildly alkaline; gradual smooth boundary.

C2—44 to 56 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; about 8 percent gravel, by volume; violent effervescence; mildly alkaline; gradual smooth boundary.

2C3—56 to 60 inches; very pale brown (10YR 7/3) gravelly loamy sand, light yellowish brown (10YR 6/4) moist; single grain; about 30 percent gravel; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 15 to 36 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches and commonly includes the upper part of the Bt horizon.

The A horizon has value of 2 or 3 moist. It is typically loam, but the range includes fine sandy loam and clay loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically clay loam, but the range includes loam and sandy clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically loam and fine sandy loam, but the range includes very fine sandy loam. The 2C horizon has hue of 7.5YR or 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 3 to 6. It is typically gravelly loamy sand, but the range includes gravelly sand, gravelly coarse sand, and gravelly sandy loam.

Sidney Series

The Sidney series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous colluvium that weathered from weakly cemented, fine grained, limy sandstone. Slopes range from 3 to 9 percent.

Sidney soils are commonly adjacent to Alliance, Altvan, Canyon, and Rosebud soils. Alliance soils have an argillic horizon and have finer textured material throughout the profile than the Sidney soils. They are in landscape positions similar to those of the Sidney soils. Altvan soils have an argillic horizon and have gravelly sand at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Sidney soils. Canyon soils are shallow to weakly cemented, fine grained, limy sandstone bedrock. They are on ridgetops and dissected side slopes. Rosebud soils have an argillic horizon and are moderately deep to weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Sidney soils.

Typical pedon of Sidney loam, in an area of Sidney-Canyon complex, 3 to 9 percent slopes, 1,200 feet

south and 225 feet east of the northwest corner of sec. 27, T. 14 N., R. 51 W.

- Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; strong effervescence; mildly alkaline; abrupt smooth boundary.
- Bw—7 to 10 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium granular; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.
- Bk—10 to 18 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable; common soft masses of lime; violent effervescence; moderately alkaline; clear smooth boundary.
- C1—18 to 42 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.
- C2—42 to 50 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; strongly alkaline; abrupt smooth boundary.
- Cr—50 to 60 inches; white (10YR 8/2) weakly cemented, fine grained, limy sandstone bedrock, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum ranges from 10 to 30 inches. The depth to carbonates ranges from 0 to 18 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Depth to the Cr horizon ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes fine sandy loam. The Bw horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam, very fine sandy loam, and fine sandy loam. Some pedons have an AC horizon. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is typically loam, but the range includes very fine sandy loam, fine sandy loam, and sandy loam.

Tassel Series

The Tassel series consists of shallow, well drained, moderately rapidly permeable soils on uplands. The soils formed in calcareous material weathered from weakly cemented, fine grained sandstone. Slopes range from 3 to 60 percent.

Tassel soils are commonly adjacent to Busher and

Dix soils and areas of Rock outcrop. Busher soils are deep and have a mollic epipedon. They are on the smoother, less steep slopes in landscape positions similar to those of the Tassel soils. Dix soils are excessively drained. They have very gravelly sand at a depth of 10 to 20 inches. They are in landscape positions similar to those of the Tassel soils. Areas of Rock outcrop consist of sandstone. They are on the upper parts of dissected side slopes and on the summits of narrow ridgetops.

Typical pedon of Tassel loamy very fine sand, in an area of Tassel-Busher complex, 3 to 30 percent slopes, 2,500 feet east and 2,300 feet north of the southwest corner of sec. 20, T. 17 N., R. 50 W.

- A1—0 to 3 inches; dark grayish brown (10YR 4/2) loamy very fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.
- A2—3 to 6 inches; brown (10YR 5/3) loamy very fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; about 2 percent sandstone gravel, by volume; strong effervescence; mildly alkaline; clear smooth boundary.
- C—6 to 13 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; about 12 percent gravel, by volume; violent effervescence; moderately alkaline; gradual smooth boundary.
- Cr—13 to 60 inches; white (10YR 8/2) weakly cemented, fine grained sandstone bedrock, light gray (10YR 7/2) moist; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 3 to 9 inches. The depth to free carbonates is 0 to 3 inches. Depth to the Cr horizon ranges from 6 to 20 inches.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is typically loamy very fine sand, but the range includes fine sandy loam, loamy fine sand, or very fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is typically gravelly loamy very fine sand, but the range includes loamy very fine sand, fine sandy loam, or loamy fine sand.

Ulysses Series

The Ulysses series consists of very deep, well drained, moderately permeable soils on uplands. They formed in calcareous loess. Slopes range from 1 to 6 percent.

Ulysses soils are commonly adjacent to Alliance, Keith, Kuma, and Rosebud soils. Alliance and Keith

soils have free carbonates below a depth of 15 inches and have an argillic horizon. They are in landscape positions similar to those of the Ulysses soils. Alliance soils have weakly cemented, fine grained, limy sandstone bedrock below a depth of 40 inches. Kuma soils have a mollic epipedon more than 20 inches thick and have a buried soil. They are slightly lower on the landscape than the Ulysses soils. Rosebud soils have an argillic horizon and are moderately deep over weakly cemented, fine grained, limy sandstone bedrock. They are in landscape positions similar to those of the Ulysses soils.

Typical pedon of Ulysses loam, 1 to 3 percent slopes, 1,200 feet east and 100 feet south of the northwest corner of sec. 10, T. 12 N., R. 52 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—6 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; neutral; clear smooth boundary.

Bw—12 to 19 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

BC—19 to 24 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C—24 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline.

The solum is 10 to 24 inches thick. The depth to free carbonates is 7 to 15 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bw horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes very fine sandy loam and loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4. It is silt loam, loam, or very fine sandy loam.

Valent Series

The Valent series consists of very deep, excessively drained, rapidly permeable soils on undulating to dune uplands. The soils formed in uniform eolian material that weathered from a variety of sources. Slopes range from 6 to 9 percent.

Valent soils are commonly adjacent to Busher, Duroc, Jayem, and Keith soils. Busher soils have a mollic epipedon and have weakly cemented sandstone bedrock at a depth of 40 to 60 inches. They are on ridgetops and convex side slopes. Duroc soils are pachic and have finer textured material than the Valent soils. They are in the less sloping areas in upland swales and near drainageways. Jayem soils have a mollic epipedon and contain slightly more silt than the Valent soils. They are in the less sloping areas, generally at higher elevations. Keith soils have a mollic epipedon, have finer textured material than the Valent soils, and have an argillic horizon. They are on broad upland divides and side slopes.

Typical pedon of Valent loamy fine sand, 6 to 9 percent slopes, 1,900 feet south and 80 feet east of the northwest corner of sec. 24, T. 16 N., R. 49 W.

Ap—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; loose, very friable; neutral; abrupt smooth boundary.

AC—6 to 12 inches; brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine granular; loose, very friable; neutral; clear smooth boundary.

C1—12 to 57 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose, very friable; neutral; gradual smooth boundary.

C2—57 to 60 inches; light gray (10YR 7/2) and very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 9 to 19 inches. The depth to free carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically loamy fine sand, but the range includes loamy sand. The AC horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is loamy fine sand, but the range includes fine sand and loamy sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is typically loamy fine sand, but the range includes fine sand and loamy sand.

Formation of the Soils

Soil forms through processes acting on deposited or accumulated geologic material. The characteristics of the soil are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Generally, a long time is required for the development of distinct horizons, but more or less time may be required, depending on the other soil-forming factors.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other factors. Some of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mineral material in which the soil forms. It determines the mineralogical and chemical composition of the soil. The soils in Cheyenne County formed in material that weathered from the underlying geologic formations or in material that was transported by wind or water (fig. 26). These materials are Brule siltstone, Ogallala sandstone, sands and gravel of Pleistocene age or of older origin, loess, eolian loamy sand, alluvium and mixed alluvium, and colluvium.

The Brule Formation is at or near the surface along Lodgepole Creek and Sidney Draw. It is made up of

beds of volcanic ash containing calcareous siltstone. The soils formed in place or in material that was locally reworked and transported by wind and water. These deposits range in thickness from a few inches to several feet. Epping and Mitchell soils formed in this material.

The Ogallala Group extends throughout the county. It is primarily fine grained to coarse grained, calcareous sandstone with some locally thin layers of gravel, silt, and clay and some beds of volcanic ash. Much of the Ogallala Group is cemented by calcium carbonate. Thus, the rock ranges from friable caliche that is only partly indurated to relatively hard, resistant mortar beds that form ledges. Canyon, Busher, Rosebud, and Tassel soils formed in material weathered from the Ogallala Group.

Sand and gravel of Pleistocene age or of older origin occur in areas throughout the county. They are mainly in association with some sort of drainage but may be in areas that appear to have been capped by this material at an early time. Dix and Altvan soils formed in material mixed with or weathered from these beds.

A thin mantle of loess, or wind-deposited silty material, covers large areas of the uplands in the county. It is friable, calcareous, massive, and generally yellowish brown. It ranges from a few inches to several feet thick. Keith, Kuma, and Ulysses soils formed in the thicker deposits of loess. Alliance soils formed in loess underlain by material weathered from the Ogallala Group. Some of the shallow and moderately deep soils underlain by material weathered from the Ogallala Group have varying amounts of loess mixed in the upper layers of the soil. Lodgepole soils formed in loess that has been modified by water in upland depressions.

Eolian loamy sand covers only small areas in the northern and north-central parts of the county. It is a mixture of silt and sand that has been deposited by wind. In some areas this material is calcareous, and in others the calcium carbonate appears to have been flushed downward to some depth. Valent and Jayem soils formed in wind-deposited loamy sands and sandy loams. Busher soils formed in material weathered from the Ogallala Group and have been affected by these wind-deposited materials in various degrees.

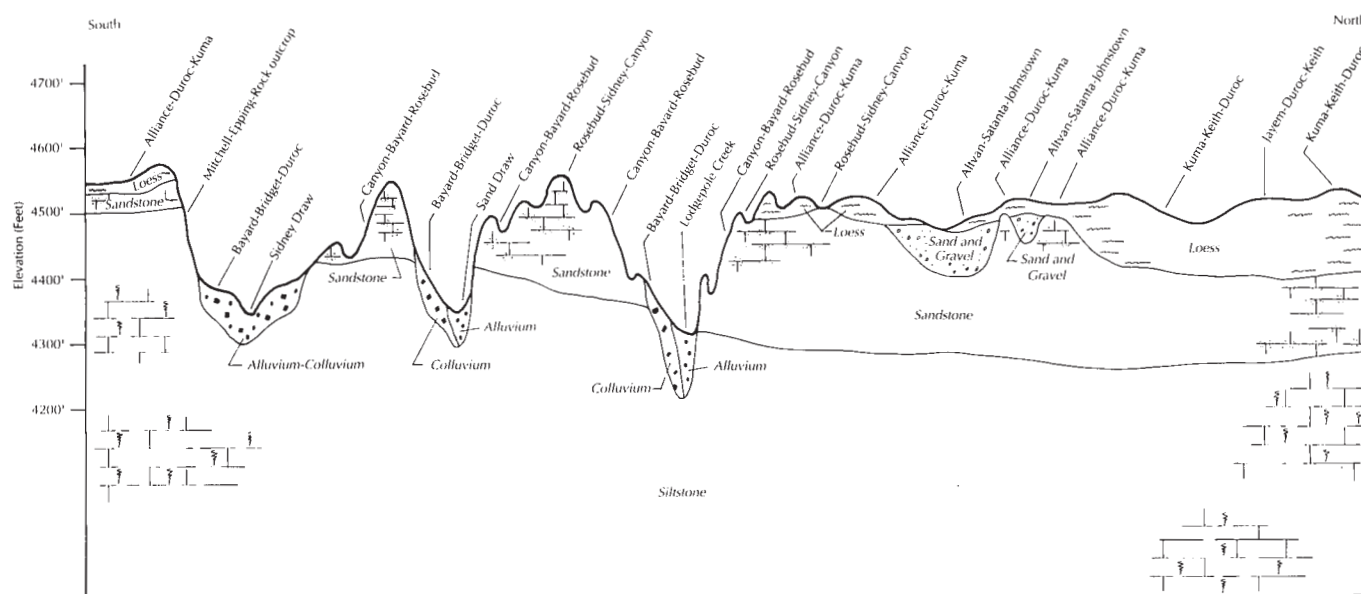


Figure 26.—A generalized north-south cross section through western Cheyenne County that shows the relationship of parent material, soil associations, and elevation.

Alluvium consists of sand, silt, clay, and some gravel washed from the higher areas and deposited by streams. It is on flood plains and stream terraces. These deposits are young and generally have weakly expressed horizons. Bankard and Glenberg soils formed in coarser alluvial material. Duroc and Goshen soils formed in silty alluvial material and may have been influenced by some wind-borne deposits.

Alluvium and colluvium have been deposited on foot slopes at the base of hills and along small drainageways or in swales. Except for a dark surface layer, the soils formed in these materials have only weakly expressed horizons. Bayard, Bridget, and Duroc soils formed in these materials.

Climate

Cheyenne County has a semiarid climate that is characterized by cold winters; short, hot summers; high winds; and frequent changes in weather conditions. The mean annual temperature is 47 degrees F. It ranges from more than 100 degrees F in summer to well below 0 degrees F in winter. The annual precipitation is about 19 inches, and most of it falls between April and September. Much of the precipitation occurs as short, violent thunderstorms during spring and summer. Hailstorms and tornadoes occur occasionally. The growing season averages between 130 and 135 days.

Because the climate is generally uniform throughout

the county, differences in the soils are a result of the relationship between the climate and the other soil-forming factors. For example, the amount of leaching is dependent not only on the amount of precipitation in an area but also on relief. The steeply sloping soils have greater runoff and less leaching than the nearly level soils that receive the same amount of rainfall. Rain, melting snow, and wind result in erosion, which can prevent the development of a thick surface, especially in the steeper areas.

The amount of moisture and the prevailing temperature during the growing season affect the amount of vegetation, which is the principal source of organic matter in the soils. These factors also affect the chemical processes and activities of micro-organisms that convert organic matter to humus. Alternate freezing and thawing and wetting and drying speed the mechanical and chemical weathering processes and also improve the physical condition of the soil.

Strong winds have influenced the formation of soils in the county by transferring soil material from one place to another and mixing, sorting, and thinning or thickening the surface layer, thus causing changes in the physical properties of the horizon. Hot winds in the summer have a serious drying effect on the soil, and high winds in the winter, which blow over the exposed soil, both contribute to the redistribution of soil material from place to place. The combination of high winds and short, intense rainfall has eroded many of the

unprotected soil surfaces in the county, especially on the moderately coarse and coarse soils, and has removed part or all of the organic matter.

Plant and Animal Life

After the parent material has been weathered and deposited, it is invaded by bacteria, fungi, and other simple forms of plant and animal life. In time, more complex forms of life develop. Plants and animals living on and in the soil produce organic matter, which influences the physical and chemical properties of the soil. For instance, prairie grasses grow and produce fibrous roots, which penetrate the soil to a depth of several feet. These roots transport water and soluble minerals, such as calcium, iron, phosphorus, nitrogen, and sulfur, to the surface, thus improving fertility. The roots also help improve soil structure and increase soil permeability and porosity, thus improving soil aeration.

As plants and animals decay, micro-organisms, such as bacteria, nematodes, fungi, and protozoa, act on them to form humus, which is a source of nutrients. Nitrogen-fixing bacteria in nodules on the roots of legumes take in nitrogen from the air. When these bacteria die, the nitrogen becomes available to plants. Earthworms, insects, and small burrowing animals mix the organic and mineral matter. This activity speeds soil development and increases friability. On poorly drained, poorly aerated soils, micro-organisms and earthworms act slowly because of a low oxygen supply. Thus, the organic matter from plants and animals decays more slowly than on the better drained soils.

As humus accumulates, the color of the surface layer gradually becomes darker and the physical and chemical characteristics change. The humus supplies nutrients to plants and other organisms, improves tilth and permeability, and increases the rate of water infiltration.

Human activities have a major effect on soil formation. Cropping sequences, terraces, irrigation, and summer fallow have changed the relationships among soil, water, and erosion that have existed for thousands of years. Removal of the grass cover has exposed the fertile surface layer to erosion. Terraces have reduced the amount of erosion and have increased chemical activity and weathering by concentrating the water supply in certain areas. Irrigation and summer fallow have increased the moisture supply and also the rates of chemical weathering and water infiltration.

Relief

Relief, or lay of the land, influences soil formation mainly through its effect on drainage, runoff, and plant growth. The slope, the shape of the surface, and the

permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soil. Internal drainage and the availability of moisture are important factors in the formation of soil horizons.

The nearly level to gently sloping soils on uplands are more strongly developed and have more distinct horizons than those of the steeper soils. They absorb more moisture and have less runoff, and water percolates deeper into the profile. Consequently, lime, nutrients, and clay particles are leached in these soils and more developed and distinct horizons form.

In upland depressions, runoff is slow and the soils receive runoff from the higher areas. Because of the extra moisture, these soils have a thick, dark surface layer and good horizon development. Lodgepole soils are an example.

In the steep areas where runoff is rapid and little moisture penetrates the soil, erosion removes the surface soil almost as fast as it forms. Lime and elements are not leached to so great a depth as they are in the less sloping soils. The soils on ridges and hilltops are more exposed to winds than those in the lower areas and therefore are more susceptible to moisture loss by evaporation. The steep soils show little profile development other than a slightly dark, thin surface layer.

The soils on bottom land have very little relief, but their landscape position influences their development. Some of these soils have a local seasonal high water table that affects the decay of organic matter, the soil temperature, and the degree of alkalinity. Other soils on bottom land are subject to flooding and to occasional deposition of sediments. All of these influences affect the kind and amount of vegetation and the development of the soil.

Time

Time is required for the formation of a mature soil. The length of time needed depends on the influence of the other four soil-forming factors. Mature soils have a thick, dark surface layer and a distinct subsoil. These soils have parent material that has been in place long enough to be altered by climate, relief, and plant and animal life. Mature soils have reached an equilibrium with their environment.

Most of the soils on bottom land are immature and do not have well developed horizons because new deposits of alluvium and colluvium are made before soil development can take place. The upland soils that have moderately steep and steep slopes have been in place long enough for horizons to form. Because of the slope, however, soil material erodes before well defined horizons can form.

The degree of profile development depends on the intensity of the soil-forming factors, the length of time that the factors have been active, and the nature of the

parent material. Differences in the length of time that the material has been in place are commonly proportional to the degree of horizon distinction.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon.

Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9

High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity.

but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate

pressure between thumb and forefinger, but resistance is distinctly noticeable.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The total thickness of weathered soil material over bedrock. In this survey the classes of soil depth are shallow, less than 20 inches; moderately deep, 20 to 40 inches; deep, 40 to 60 inches; and very deep, more than 60 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much

of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by

water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3

inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasesers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasesers commonly are the shorter plants and are less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in

production of crops. Methods of irrigation are:

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with

hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile.

Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially

drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated,

weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic

criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the classes of slope are:

Nearly level.....	0 to 1 percent, 0 to 2 percent
Very gently sloping.....	1 to 3 percent
Gently sloping.....	3 to 6 percent
Strongly sloping.....	6 to 9 percent
Moderately steep.....	9 to 17 percent
Steep.....	17 to 30 percent
Very steep.....	30 to 60 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05
Silt.....	0.05 to 0.002
Clay.....	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant

and animal activities are largely confined to the solum.

Strippcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or

undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress

roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION
(Recorded in the period 1951-84 at Sidney, Nebraska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	° F	° F	° F	° F	° F	Units	In	In	In		In
January-----	38.0	11.3	24.7	64	-19	0	0.41	0.07	0.64	2	5.2
February-----	43.4	16.1	29.8	71	-12	0	.37	.04	.58	1	4.6
March-----	47.1	20.4	33.8	76	-7	7	1.27	.30	1.99	3	9.9
April-----	58.4	30.1	44.3	94	8	37	1.86	.76	2.66	5	6.7
May-----	68.3	40.6	54.5	90	25	171	3.48	1.39	5.02	7	1.2
June-----	79.7	50.2	65.0	99	35	450	3.37	1.38	4.80	7	.0
July-----	87.6	56.9	72.3	102	44	691	2.85	1.15	4.04	6	.0
August-----	85.9	55.1	70.5	100	42	636	1.99	.63	2.86	5	.0
September---	76.3	44.4	60.4	96	25	324	1.15	.21	1.82	3	.1
October-----	64.2	32.7	48.5	88	15	83	1.01	.26	1.59	2	2.6
November----	49.3	20.9	35.1	75	-3	0	.55	.10	.79	2	6.0
December----	40.4	13.8	27.1	69	-13	0	.45	.07	.71	2	5.1
Yearly:											
Average---	61.6	32.7	47.2	---	---	---	---	---	---	---	---
Extreme---	107	-30	---	103	-22	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,399	18.76	15.29	22.47	45	41.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL
(Recorded in the period 1951-84 at Sidney, Nebraska)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 5	May 20	May 31
2 years in 10 later than--	May 1	May 14	May 26
5 years in 10 later than--	Apr. 23	May 3	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 29	Sept. 19	Sept. 12
2 years in 10 earlier than--	Oct. 5	Sept. 24	Sept. 17
5 years in 10 earlier than--	Oct. 15	Oct. 4	Sept. 25

TABLE 3.--GROWING SEASON
(Recorded in the period 1951-84 at Sidney,
Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	154	130	111
8 years in 10	161	138	118
5 years in 10	175	152	132
2 years in 10	189	167	146
1 year in 10	196	175	153

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ao	Alliance loam, 0 to 1 percent slopes-----	22,780	3.0
AoB	Alliance loam, 1 to 3 percent slopes-----	67,310	8.8
AoC	Alliance loam, 3 to 6 percent slopes-----	14,590	1.9
AtB	Altvan loam, 1 to 3 percent slopes-----	11,190	1.5
AtC	Altvan loam, 3 to 6 percent slopes-----	11,120	1.5
AvD	Altvan-Dix complex, 3 to 9 percent slopes-----	15,490	2.0
Bb	Bankard loamy sand, 0 to 2 percent slopes-----	5,970	0.8
Bc	Bankard loamy fine sand, channeled-----	8,010	1.0
Be	Bayard fine sandy loam, 0 to 1 percent slopes-----	4,100	0.5
BeB	Bayard fine sandy loam, 1 to 3 percent slopes-----	12,840	1.7
BeC	Bayard fine sandy loam, 3 to 6 percent slopes-----	10,670	1.4
BeD	Bayard fine sandy loam, 6 to 9 percent slopes-----	4,270	0.6
BeE	Bayard fine sandy loam, 9 to 20 percent slopes-----	1,190	0.2
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes-----	7,210	0.9
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes-----	8,710	1.1
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes-----	4,850	0.6
BgD	Bridget very fine sandy loam, 6 to 9 percent slopes-----	1,170	0.2
BuC	Busher fine sandy loam, 3 to 6 percent slopes-----	800	0.1
BxD	Busher-Tassel complex, 3 to 9 percent slopes-----	3,690	0.5
ByE	Busher-Tassel complex, 9 to 20 percent slopes-----	3,630	0.5
CcF	Canyon fine sandy loam, 6 to 30 percent slopes-----	17,380	2.3
CdG	Canyon-Rock outcrop complex, 11 to 60 percent slopes-----	15,060	2.0
CeE	Canyon-Bayard complex, 6 to 20 percent slopes-----	33,520	4.4
CtB	Creighton very fine sandy loam, 1 to 3 percent slopes-----	1,000	0.1
CtC	Creighton very fine sandy loam, 3 to 6 percent slopes-----	660	0.1
DhD	Dix gravelly loam, 3 to 11 percent slopes-----	11,810	1.5
DhG	Dix gravelly loam, 11 to 50 percent slopes-----	8,710	1.1
Du	Duroc loam, 0 to 1 percent slopes-----	63,040	8.2
DuB	Duroc loam, 1 to 3 percent slopes-----	13,770	1.8
Dv	Duroc loam, terrace, gravelly substratum, 0 to 1 percent slopes-----	710	0.1
Dx	Duroc silt loam, terrace, 0 to 1 percent slopes-----	7,320	1.0
DyE	Dwyer loamy fine sand, 9 to 17 percent slopes-----	530	0.1
ErE	Epping-Mitchell complex, 3 to 20 percent slopes-----	2,670	0.3
Gd	Glenberg fine sandy loam, 0 to 2 percent slopes-----	7,690	1.0
Go	Goshen silt loam, 0 to 1 percent slopes-----	7,290	1.0
JmB	Jayem fine sandy loam, 1 to 3 percent slopes-----	4,580	0.6
JmC	Jayem fine sandy loam, 3 to 6 percent slopes-----	6,210	0.8
Jo	Johnstown loam, 0 to 1 percent slopes-----	6,290	0.8
Ke	Keith loam, 0 to 1 percent slopes-----	4,660	0.6
KeB	Keith loam, 1 to 3 percent slopes-----	70,950	9.3
KeC	Keith loam, 3 to 6 percent slopes-----	6,380	0.8
Ku	Kuma loam, 0 to 1 percent slopes-----	96,316	12.6
Lm	Las loam, 0 to 1 percent slopes-----	3,490	0.5
Lw	Las Animas loam, 0 to 2 percent slopes-----	800	0.1
Ly	Lodgepole silt loam, 0 to 1 percent slopes-----	1,770	0.2
Mc	McCook very fine sandy loam, 0 to 1 percent slopes-----	2,340	0.3
MkC	Mitchell very fine sandy loam, 3 to 6 percent slopes-----	1,280	0.2
MkD	Mitchell very fine sandy loam, 6 to 9 percent slopes-----	1,120	0.1
MkE	Mitchell very fine sandy loam, 9 to 20 percent slopes-----	510	0.1
Pg	Pits, sand and gravel-----	330	*
ReG	Rock outcrop-Epping complex, 11 to 60 percent slopes-----	880	0.1
RhG	Rock outcrop-Tassel complex, 20 to 60 percent slopes-----	790	0.1
Ro	Rosebud loam, 0 to 1 percent slopes-----	4,680	0.6
RoB	Rosebud loam, 1 to 3 percent slopes-----	23,810	3.1
RoC	Rosebud loam, 3 to 6 percent slopes-----	12,260	1.6
RSD	Rosebud-Canyon complex, 3 to 9 percent slopes-----	15,690	2.0
Sb	Satanta loam, gravelly substratum, 0 to 1 percent slopes-----	3,130	0.4
SbB	Satanta loam, gravelly substratum, 1 to 3 percent slopes-----	13,480	1.8
SbC	Satanta loam, gravelly substratum, 3 to 6 percent slopes-----	5,620	0.7
SnC	Sidney loam, 3 to 6 percent slopes-----	3,740	0.5
SoD	Sidney-Canyon complex, 3 to 9 percent slopes-----	54,410	7.1
TbF	Tassel-Busher complex, 3 to 30 percent slopes-----	4,630	0.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
TcG	Tassel-Busher-Rock outcrop complex, 11 to 60 percent slopes-----	1,580	0.2
UyB	Ulysses loam, 1 to 3 percent slopes-----	1,500	0.2
UyC	Ulysses loam, 3 to 6 percent slopes-----	740	0.1
VdD	Valent loamy fine sand, 6 to 9 percent slopes-----	660	0.1
	Water areas more than 40 acres in size-----	122	*
	Total-----	765,498	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Ao	Alliance loam, 0 to 1 percent slopes (where irrigated)
AoB	Alliance loam, 1 to 3 percent slopes (where irrigated)
AoC	Alliance loam, 3 to 6 percent slopes (where irrigated)
AtB	Altvan loam, 1 to 3 percent slopes (where irrigated)
AtC	Altvan loam, 3 to 6 percent slopes (where irrigated)
Be	Bayard fine sandy loam, 0 to 1 percent slopes (where irrigated)
BeB	Bayard fine sandy loam, 1 to 3 percent slopes (where irrigated)
BeC	Bayard fine sandy loam, 3 to 6 percent slopes (where irrigated)
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes (where irrigated)
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes (where irrigated)
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes (where irrigated)
BuC	Busher fine sandy loam, 3 to 6 percent slopes (where irrigated)
CtB	Creighton very fine sandy loam, 1 to 3 percent slopes (where irrigated)
CtC	Creighton very fine sandy loam, 3 to 6 percent slopes (where irrigated)
Du	Duroc loam, 0 to 1 percent slopes (where irrigated)
DuB	Duroc loam, 1 to 3 percent slopes (where irrigated)
Dv	Duroc loam, terrace, gravelly substratum, 0 to 1 percent slopes (where irrigated)
Dx	Duroc silt loam, terrace, 0 to 1 percent slopes (where irrigated)
Gd	Glenberg fine sandy loam, 0 to 2 percent slopes (where irrigated)
Go	Goshen silt loam, 0 to 1 percent slopes (where irrigated)
JmB	Jayem fine sandy loam, 1 to 3 percent slopes (where irrigated)
JmC	Jayem fine sandy loam, 3 to 6 percent slopes (where irrigated)
Jo	Johnstown loam, 0 to 1 percent slopes (where irrigated)
Ke	Keith loam, 0 to 1 percent slopes (where irrigated)
KeB	Keith loam, 1 to 3 percent slopes (where irrigated)
KeC	Keith loam, 3 to 6 percent slopes (where irrigated)
Ku	Kuma loam, 0 to 1 percent slopes (where irrigated)
Lm	Las loam, 0 to 1 percent slopes (where irrigated)
Mc	McCook very fine sandy loam, 0 to 1 percent slopes (where irrigated)
Ro	Rosebud loam, 0 to 1 percent slopes (where irrigated)
RoB	Rosebud loam, 1 to 3 percent slopes (where irrigated)
RoC	Rosebud loam, 3 to 6 percent slopes (where irrigated)
Sb	Satanta loam, gravelly substratum, 0 to 1 percent slopes (where irrigated)
SbB	Satanta loam, gravelly substratum, 1 to 3 percent slopes (where irrigated)
SbC	Satanta loam, gravelly substratum, 3 to 6 percent slopes (where irrigated)
SnC	Sidney loam, 3 to 6 percent slopes (where irrigated)
UyB	Ulysses loam, 1 to 3 percent slopes (where irrigated)
UyC	Ulysses loam, 3 to 6 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Corn		Winter wheat		Dry beans		Millet		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
Ao----- Alliance	IIc	I	---	145	43	---	---	40	27	---	---	5.6
AoB----- Alliance	IIe	IIe	---	140	41	---	---	38	25	---	---	5.3
AoC----- Alliance	IIIe	IIIe	---	130	36	---	---	34	21	---	---	4.7
AtB----- Altvan	IIIe	IIIe	---	125	34	---	---	33	18	---	---	4.2
AtC----- Altvan	IVe	IVe	---	110	28	---	---	28	15	---	---	3.6
AvD----- Altvan-Dix	IVe	IVe	---	95	23	---	---	23	12	---	---	3.1
Bb----- Bankard	IVe	IVe	---	100	22	---	---	24	14	---	---	3.3
Bc----- Bankard	VIw	---	---	---	---	---	---	---	---	---	---	---
Be----- Bayard	IIe	IIe	---	140	41	---	---	40	26	---	---	5.4
BeB----- Bayard	IIIe	IIe	---	135	37	---	---	37	24	---	---	5.0
BeC----- Bayard	IVe	IIIe	---	125	34	---	---	32	19	---	---	4.4
BeD----- Bayard	IVe	IVe	---	115	29	---	---	27	15	---	---	3.7
BeE----- Bayard	VIe	---	---	---	---	---	---	---	---	---	---	---
Bg----- Bridget	IIc	IIe	---	145	42	---	---	40	27	---	---	5.8
BgB----- Bridget	IIe	IIe	---	140	40	---	---	38	25	---	---	5.4
BgC----- Bridget	IIIe	IIIe	---	130	35	---	---	34	20	---	---	4.7
BgD----- Bridget	IVe	IVe	---	115	30	---	---	28	16	---	---	4.0
BuC----- Bushier	IIIe	IIIe	---	120	33	---	---	31	19	---	---	3.5
BxD----- Bushier-Tassel	IVe	IVe	---	100	27	---	---	25	15	---	---	---

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Dry beans		Millet		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
ByE----- Bushier-Tassel	VIe	---	---	---	---	---	---	---	---	---	---	---
CcF----- Canyon	VIIs	---	---	---	---	---	---	---	---	---	---	---
CdG*----- Canyon-Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---	---	---
CeE----- Canyon-Bayard	VIIs	---	---	---	---	---	---	---	---	---	---	---
CtB----- Creighton	IIe	IIe	---	135	39	---	---	36	24	---	---	5.4
CtC----- Creighton	IIIe	IIIe	---	120	34	---	---	32	---	---	---	4.7
DhD----- Dix	VIIs	---	---	---	---	---	---	---	---	---	---	---
DhG----- Dix	VIIs	---	---	---	---	---	---	---	---	---	---	---
Du----- Duroc	IIc	I	---	150	47	---	---	40	---	---	---	6.0
DuB----- Duroc	IIe	IIe	---	140	45	---	---	38	---	---	---	5.5
Dv----- Duroc	IIc	I	---	140	41	---	---	40	27	---	---	5.8
Dx----- Duroc	IIc	I	---	140	43	---	---	40	---	---	---	5.8
DyE----- Dwyer	VIe	---	---	---	---	---	---	---	---	---	---	---
ErE----- Epping-Mitchell	VIIs	---	---	---	---	---	---	---	---	---	---	---
Gd----- Glenberg	IIIe	IIe	32	135	36	---	---	34	21	---	---	5.0
Go----- Goshen	IIc	I	---	145	46	---	---	40	30	---	---	6.0
JmB----- Jayem	IIIe	IIe	---	130	35	---	---	34	19	---	---	5.0
JmC----- Jayem	IVe	IIIe	---	120	30	---	---	30	15	---	---	4.3
Jo----- Johnstown	IIc	I	45	145	43	---	---	40	28	---	2.5	5.6
Ke----- Keith	IIc	I	---	145	44	---	---	42	25	---	1.7	6.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Dry beans		Millet		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
KeB----- Keith	IIe	IIe	---	140	42	---	---	38	26	---	---	5.3
KeC----- Keith	IIIe	IIIe	---	130	37	---	---	34	22	---	---	4.7
Ku----- Kuma	IIC	I	---	146	45	---	---	40	29	---	---	5.8
Lm----- Las	IVw	IIw	---	135	28	---	---	35	21	---	---	6.0
Lw----- Las Animas	Vw	---	---	---	---	---	---	---	---	---	---	---
Ly----- Lodgepole	IIIw	IVw	75	90	22	---	19	25	15	---	---	3.8
Mc----- McCook	IIC	IIe	45	140	40	---	---	40	27	---	---	5.8
MkC----- Mitchell	IIIe	IIIe	---	125	34	---	---	34	19	---	---	4.6
MkD----- Mitchell	IVe	IVe	---	105	29	---	---	26	15	---	1.6	3.9
MkE----- Mitchell	VIe	---	---	---	---	---	---	---	---	---	---	---
Pg*----- Pits	VIIIIs	---	---	---	---	---	---	---	---	---	---	---
ReG----- Rock outcrop- Epping	VIIIs	---	---	---	---	---	---	---	---	---	---	---
RhG----- Rock outcrop- Tassel	VIIIs	---	---	---	---	---	---	---	---	---	---	---
Ro----- Rosebud	IIIC	I	---	135	38	---	---	35	21	---	---	5.2
RoB----- Rosebud	IIIe	IIIe	---	130	36	---	---	33	19	---	---	4.7
RoC----- Rosebud	IVe	IIIe	---	110	31	---	---	28	15	---	---	4.0
RsD----- Rosebud-Canyon	IVe	---	---	---	28	---	---	---	14	---	---	---
Sb----- Satanta	IIC	I	---	145	40	---	---	40	27	---	---	5.6
SbB----- Satanta	IIe	IIe	---	140	38	---	---	38	24	---	---	5.3
SbC----- Satanta	IIIe	IIIe	---	125	32	---	---	30	19	---	---	4.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Dry beans		Millet		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
SnC----- Sidney	IIIe	IIIe	---	125	32	---	---	30	17	---	---	4.2
SoD----- Sidney-Canyon	IVe	---	---	---	27	---	---	---	14	---	---	---
TbF----- Tassel-Busher	VIIs	---	---	---	---	---	---	---	---	---	---	---
TcG*----- Tassel-Busher- Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---	---	---
UyB----- Ulysses	IIe	IIe	---	120	36	50	---	---	---	---	---	5.0
UyC----- Ulysses	IIIe	IIIe	---	105	31	57	---	---	---	---	---	4.4
VdD----- Valent	VIe	IVe	---	100	---	---	---	---	---	---	---	3.3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		<u>Acre</u> s	<u>Acre</u> s	<u>Acre</u> s	<u>Acre</u> s
I (N)	---	---	---	---	---
(I)	216,216	---	---	---	---
II (N)	393,876	180,820	---	---	213,056
(I)	218,970	215,480	3,490	---	---
III (N)	125,510	111,030	1,770	---	12,710
(I)	102,800	102,800	---	---	---
IV (N)	95,225	91,735	3,490	---	---
(I)	77,285	75,515	1,770	---	---
V (N)	800	---	800	---	---
VI (N)	132,515	24,091	8,010	100,414	---
VII (N)	9,934	---	---	9,934	---
VIII(N)	7,509	---	---	7,509	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ao, AoB, AoC----- Alliance	Silty-----	Favorable	2,500	Blue grama-----	20
		Normal	1,700	Western wheatgrass-----	20
		Unfavorable	1,000	Needleandthread-----	20
				Buffalograss-----	5
				Little bluestem-----	5
				Sedge-----	5
				Green needlegrass-----	5
				Big bluestem-----	5
AtB, AtC----- Altvan	Silty-----	Favorable	2,900	Little bluestem-----	15
		Normal	2,500	Blue grama-----	15
		Unfavorable	2,100	Western wheatgrass-----	15
				Needleandthread-----	15
				Big bluestem-----	10
				Buffalograss-----	5
				Threadleaf sedge-----	5
				Sidecoats grama-----	5
AvD*: Altvan-----	Silty-----	Favorable	2,900	Little bluestem-----	15
		Normal	2,500	Blue grama-----	15
		Unfavorable	2,100	Western wheatgrass-----	15
				Needleandthread-----	15
				Big bluestem-----	10
				Buffalograss-----	5
				Threadleaf sedge-----	5
				Sidecoats grama-----	5
Dix-----	Shallow to Gravel-----	Favorable	700	Blue grama-----	25
		Normal	600	Fendler threeawn-----	10
		Unfavorable	400	Needleandthread-----	10
				Sand bluestem-----	5
				Little bluestem-----	5
				Buffalograss-----	5
				Prairie sandreed-----	5
Bb----- Bankard	Sandy Lowland-----	Favorable	2,300	Prairie sandreed-----	30
		Normal	2,100	Sand bluestem-----	20
		Unfavorable	1,800	Little bluestem-----	20
				Needleandthread-----	10
				Blue grama-----	5
Bc----- Bankard	Shallow to Gravel-----	Favorable	900	Blue grama-----	30
		Normal	700	Needleandthread-----	10
		Unfavorable	400	Fendler threeawn-----	10
				Prairie sandreed-----	5
				Sand bluestem-----	5
				Sand dropseed-----	5
				Sedge-----	5
				Little bluestem-----	5
				Buffalograss-----	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Be, BeB, BeC, BeD, BeE----- Bayard	Sandy-----	Favorable	2,300	Prairie sandreed-----	30
		Normal	1,600	Blue grama-----	15
		Unfavorable	1,100	Needleandthread-----	15
				Sand bluestem-----	10
				Little bluestem-----	10
				Indian ricegrass-----	5
				Threadleaf sedge-----	5
Bg, BgB, BgC, BgD-- Bridget	Silty-----	Favorable	2,500	Needleandthread-----	20
		Normal	1,700	Blue grama-----	20
		Unfavorable	1,000	Western wheatgrass-----	20
				Threadleaf sedge-----	10
				Buffalograss-----	5
				Little bluestem-----	5
				Big bluestem-----	5
				Sidecoats grama-----	5
BuC----- Busher	Sandy-----	Favorable	2,300	Prairie sandreed-----	30
		Normal	1,600	Needleandthread-----	15
		Unfavorable	1,200	Blue grama-----	15
				Sand bluestem-----	10
				Little bluestem-----	10
				Threadleaf sedge-----	5
				Indian ricegrass-----	5
BxD*, ByE*: Busher-----	Sandy-----	Favorable	2,300	Prairie sandreed-----	30
		Normal	1,600	Needleandthread-----	15
		Unfavorable	1,200	Blue grama-----	15
				Sand bluestem-----	10
				Little bluestem-----	10
				Threadleaf sedge-----	5
				Indian ricegrass-----	5
Tassel-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Needleandthread-----	10
				Threadleaf sedge-----	10
				Sand bluestem-----	5
				Sidecoats grama-----	5
				Bluegrass-----	5
CcF----- Canyon	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Threadleaf sedge-----	10
				Needleandthread-----	10
				Sidecoats grama-----	5
				Sand bluestem-----	5
				Bluegrass-----	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition		
		Kind of year	Dry weight				
			Lb/acre		Pct		
CdG*: Canyon-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25		
		Normal	700	Little bluestem-----	15		
		Unfavorable	500	Western wheatgrass-----	15		
				Threadleaf sedge-----	10		
				Needleandthread-----	10		
				Sideoats grama-----	5		
				Sand bluestem-----	5		
				Bluegrass-----	5		
Rock outcrop.							
CeE*: Canyon-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25		
		Normal	700	Little bluestem-----	15		
		Unfavorable	500	Western wheatgrass-----	15		
				Threadleaf sedge-----	10		
				Needleandthread-----	10		
				Sideoats grama-----	5		
				Sand bluestem-----	5		
				Bluegrass-----	5		
Bayard-----	Sandy-----	Favorable	2,300	Prairie sandreed-----	30		
		Normal	1,600	Blue grama-----	15		
		Unfavorable	1,100	Needleandthread-----	15		
				Sand bluestem-----	10		
				Little bluestem-----	10		
				Indian ricegrass-----	5		
				Threadleaf sedge-----	5		
				CtB, CtC----- Creighton	Silty-----	Favorable	2,500
Normal	1,700	Needleandthread-----	20				
Unfavorable	1,000	Western wheatgrass-----	20				
		Threadleaf sedge-----	10				
		Buffalograss-----	10				
		Green needlegrass-----	5				
DhD, DhG----- Dix	Shallow to Gravel-----	Favorable	700	Blue grama-----	25		
		Normal	600	Fendler threeawn-----	10		
		Unfavorable	400	Needleandthread-----	10		
				Sand dropseed-----	10		
				Sand bluestem-----	5		
				Little bluestem-----	5		
				Buffalograss-----	5		
				Prairie sandreed-----	5		
Du, DuB----- Duroc	Silty-----	Favorable	3,300	Big bluestem-----	15		
		Normal	2,500	Needleandthread-----	15		
		Unfavorable	1,700	Western wheatgrass-----	15		
				Blue grama-----	10		
				Green needlegrass-----	10		
				Little bluestem-----	10		
				Threadleaf sedge-----	10		
				Buffalograss-----	5		

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Dv----- Duroc	Silty-----	Favorable	2,100	Blue grama-----	20
		Normal	1,700	Needleandthread-----	20
		Unfavorable	1,300	Green needlegrass-----	10
				Western wheatgrass-----	10
				Threadleaf sedge-----	10
				Big bluestem-----	5
				Buffalograss-----	5
				Little bluestem-----	5
Dx----- Duroc	Silty-----	Favorable	3,300	Big bluestem-----	15
		Normal	2,500	Needleandthread-----	15
		Unfavorable	1,700	Western wheatgrass-----	15
				Blue grama-----	10
				Green needlegrass-----	10
				Little bluestem-----	10
				Threadleaf sedge-----	10
				Buffalograss-----	5
DyE----- Dwyer	Sands-----	Favorable	2,300	Prairie sandreed-----	30
		Normal	1,600	Sand bluestem-----	20
		Unfavorable	1,000	Needleandthread-----	15
				Little bluestem-----	15
				Blue grama-----	10
ErE*: Epping-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	20
		Normal	700	Needleandthread-----	15
		Unfavorable	500	Threadleaf sedge-----	10
				Sideoats grama-----	10
				Western wheatgrass-----	10
				Little bluestem-----	10
				Buffalograss-----	5
				Prairie sandreed-----	5
Mitchell-----	Limy Upland-----	Favorable	2,000	Blue grama-----	20
		Normal	1,300	Sideoats grama-----	15
		Unfavorable	700	Needleandthread-----	10
				Threadleaf sedge-----	10
				Little bluestem-----	10
				Western wheatgrass-----	10
				Buffalograss-----	5
				Prairie sandreed-----	5
Gd----- Glenberg	Sandy Lowland-----	Favorable	2,800	Little bluestem-----	20
		Normal	2,100	Prairie sandreed-----	20
		Unfavorable	1,300	Sand bluestem-----	20
				Needleandthread-----	10
				Blue grama-----	10
				Switchgrass-----	5
Go----- Goshen	Silty-----	Favorable	3,300	Blue grama-----	20
		Normal	2,900	Western wheatgrass-----	20
		Unfavorable	2,500	Little bluestem-----	15
				Buffalograss-----	10
				Needleandthread-----	10
				Big bluestem-----	5
				Sideoats grama-----	5
				Sedge-----	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
JmB, JmC----- Jayem	Sandy-----	Favorable	2,300	Prairie sandreed-----	20
		Normal	1,600	Blue grama-----	15
		Unfavorable	1,100	Needleandthread-----	15
				Little bluestem-----	10
				Threadleaf sedge-----	10
				Sand bluestem-----	10
				Fringed sagebrush-----	5
				Sand dropseed-----	5
				Western wheatgrass-----	5
				Indian ricegrass-----	5
Jo----- Johnstown	Silty-----	Favorable	4,000	Big bluestem-----	20
		Normal	3,600	Little bluestem-----	20
		Unfavorable	3,300	Blue grama-----	10
				Western wheatgrass-----	10
				Switchgrass-----	5
				Indiangrass-----	5
Ke, KeB, KeC----- Keith	Silty-----	Favorable	3,300	Blue grama-----	20
		Normal	2,500	Needleandthread-----	20
		Unfavorable	1,700	Western wheatgrass-----	15
				Little bluestem-----	10
				Buffalograss-----	5
				Sedge-----	5
				Big bluestem-----	5
				Sideoats grama-----	5
Ku----- Kuma	Silty-----	Favorable	3,300	Blue grama-----	25
		Normal	2,900	Western wheatgrass-----	20
		Unfavorable	2,500	Buffalograss-----	10
				Needlegrass-----	10
				Sedge-----	5
Lm----- Las	Subirrigated-----	Favorable	5,500	Big bluestem-----	25
		Normal	5,300	Indiangrass-----	15
		Unfavorable	5,000	Little bluestem-----	15
				Prairie cordgrass-----	10
				Switchgrass-----	10
				Sedge-----	10
Lw----- Las Animas	Wetland-----	Favorable	5,000	Kentucky bluegrass-----	5
		Normal	4,500	Prairie cordgrass-----	30
		Unfavorable	4,000	Bluejoint reedgrass-----	15
				Northern reedgrass-----	15
				Slender wheatgrass-----	10
				Sedge-----	10
				Plains bluegrass-----	5
Ly----- Lodgepole	Clayey Overflow-----	Favorable	1,200	Rush-----	5
		Normal	1,000	Western wheatgrass-----	40
		Unfavorable	700	Blue grama-----	15
				Green needlegrass-----	15
				Buffalograss-----	10
				Sedge-----	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Mc----- McCook	Silty Lowland-----	Favorable	2,800	Western wheatgrass-----	30
		Normal	2,000	Needleandthread-----	15
		Unfavorable	1,500	Blue grama-----	15
				Sedge-----	10
				Big bluestem-----	5
				Little bluestem-----	5
				Sideoats grama-----	5
				Buffalograss-----	5
MkC, MkD, MkE----- Mitchell	Limy Upland-----	Favorable	2,000	Blue grama-----	20
		Normal	1,300	Sideoats grama-----	15
		Unfavorable	700	Needleandthread-----	10
				Threadleaf sedge-----	10
				Little bluestem-----	10
				Western wheatgrass-----	10
				Buffalograss-----	5
				Prairie sandreed-----	5
ReG*: Rock outcrop.					
Epping-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	20
		Normal	700	Needleandthread-----	15
		Unfavorable	500	Threadleaf sedge-----	10
				Sideoats grama-----	10
				Western wheatgrass-----	10
				Little bluestem-----	10
				Buffalograss-----	5
				Prairie sandreed-----	5
RhG*: Rock outcrop.					
Tassel-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Needleandthread-----	10
				Threadleaf sedge-----	10
				Sand bluestem-----	5
				Sideoats grama-----	5
				Bluegrass-----	5
Ro----- Rosebud	Silty-----	Favorable	2,500	Blue grama-----	25
		Normal	1,700	Needleandthread-----	20
		Unfavorable	1,000	Western wheatgrass-----	20
				Threadleaf sedge-----	10
				Green needlegrass-----	10
				Buffalograss-----	5
RoB, RoC----- Rosebud	Silty-----	Favorable	3,300	Needleandthread-----	15
		Normal	2,500	Blue grama-----	15
		Unfavorable	1,700	Western wheatgrass-----	15
				Little bluestem-----	10
				Sideoats grama-----	10
				Green needlegrass-----	10
				Big bluestem-----	5
				Threadleaf sedge-----	5
				Buffalograss-----	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
RsD*: Rosebud-----	Silty-----	Favorable	3,300	Needleandthread-----	15
		Normal	2,500	Blue grama-----	15
		Unfavorable	1,700	Western wheatgrass-----	15
				Little bluestem-----	10
				Sideoats grama-----	10
				Green needlegrass-----	10
				Big bluestem-----	5
				Threadleaf sedge-----	5
				Buffalograss-----	5
Canyon-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Threadleaf sedge-----	10
				Needleandthread-----	10
				Sideoats grama-----	5
				Sand bluestem-----	5
				Bluegrass-----	5
Sb, SbB, SbC----- Satanta	Silty-----	Favorable	2,100	Blue grama-----	20
		Normal	1,700	Needleandthread-----	20
		Unfavorable	1,300	Western wheatgrass-----	10
				Buffalograss-----	5
				Green needlegrass-----	5
				Little bluestem-----	5
				Sand dropseed-----	5
				Sideoats grama-----	5
SnC----- Sidney	Silty-----	Favorable	2,200	Western wheatgrass-----	25
		Normal	1,500	Needleandthread-----	25
		Unfavorable	1,000	Blue grama-----	20
				Sedge-----	5
				Buffalograss-----	5
SoD*: Sidney-----	Silty-----	Favorable	2,200	Western wheatgrass-----	25
		Normal	1,500	Needleandthread-----	25
		Unfavorable	1,000	Blue grama-----	20
				Sedge-----	5
				Buffalograss-----	5
Canyon-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Threadleaf sedge-----	10
				Needleandthread-----	10
				Sideoats grama-----	5
				Sand bluestem-----	5
				Bluegrass-----	5
TbF*: Tassel-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Needleandthread-----	10
				Threadleaf sedge-----	10
				Sand bluestem-----	5
				Sideoats grama-----	5
				Bluegrass-----	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
TbF*: Busher-----	Sandy-----	Favorable	3,000	Prairie sandreed-----	25
		Normal	2,300	Sand bluestem-----	20
		Unfavorable	1,700	Little bluestem-----	20
				Needleandthread-----	10
				Blue grama-----	10
				Threadleaf sedge-----	5
TcG*: Tassel-----	Shallow Limy-----	Favorable	1,000	Blue grama-----	25
		Normal	700	Little bluestem-----	15
		Unfavorable	500	Western wheatgrass-----	15
				Needleandthread-----	10
				Threadleaf sedge-----	10
				Sand bluestem-----	5
				Sideoats grama-----	5
				Bluegrass-----	5
Busher-----	Savannah-----	Favorable	3,000	Prairie sandreed-----	25
		Normal	2,300	Sand bluestem-----	20
		Unfavorable	1,700	Little bluestem-----	20
				Needleandthread-----	10
				Blue grama-----	10
				Threadleaf sedge-----	5
Rock outcrop.					
UyB, UyC----- Ulysses	Silty-----	Favorable	2,500	Western wheatgrass-----	20
		Normal	1,700	Blue grama-----	20
		Unfavorable	1,000	Needleandthread-----	20
				Sedge-----	10
				Sideoats grama-----	5
				Little bluestem-----	5
				Buffalograss-----	5
				Green needlegrass-----	5
VdD----- Valent	Sands-----	Favorable	3,000	Sand bluestem-----	25
		Normal	2,600	Prairie sandreed-----	20
		Unfavorable	2,000	Little bluestem-----	10
				Needleandthread-----	10
				Switchgrass-----	10
				Blue grama-----	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ao, AoB, AoC----- Alliance	American plum, lilac, Siberian peashrub.	Rocky Mountain juniper, hackberry, Russian-olive.	Eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, jack pine.	Siberian elm-----	---
AtB, AtC----- Altvan	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
AvD*: Altvan-----	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Dix.					
Bb----- Bankard	American plum, skunkbush sumac.	Siberian peashrub, Russian-olive, hackberry.	Eastern redcedar, honeylocust, green ash, ponderosa pine.	Siberian elm-----	---
Bc----- Bankard	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Be, BeB----- Bayard	American plum, skunkbush sumac, Siberian peashrub.	Eastern redcedar, Rocky Mountain juniper, lilac.	Ponderosa pine, Russian mulberry, green ash, hackberry, honeylocust.	Siberian elm-----	---
BeC----- Bayard	American plum, skunkbush sumac, lilac, Siberian peashrub.	Eastern redcedar, Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, green ash, hackberry, honeylocust.	Siberian elm-----	---
BeD----- Bayard	American plum, skunkbush sumac, Siberian peashrub.	Eastern redcedar, Rocky Mountain juniper, lilac.	Ponderosa pine, Russian mulberry, green ash, hackberry, honeylocust.	Siberian elm-----	---
BeE----- Bayard	---	Eastern redcedar, Austrian pine, jack pine.	Ponderosa pine, Scotch pine.	---	---
Bg, BgB, BgC, BgD- Bridget	Skunkbush sumac, lilac, American plum.	Hackberry, Rocky Mountain juniper, Russian-olive, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm-----	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BuC----- Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm-----	---
BxD*: Busher-----	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm-----	---
Tassel.					
ByE*: Busher-----	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine----	---	---
Tassel.					
CcF. Canyon					
CdG*: Canyon.					
Rock outcrop.					
CeE*: Canyon.					
Bayard-----	---	Eastern redcedar, Austrian pine, jack pine.	Ponderosa pine, Scotch pine.	---	---
CtB, CtC----- Creighton	Lilac, American plum, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm-----	---
DhD, DhG. Dix					
Du----- Duroc	Amur honeysuckle, lilac, American plum.	---	Rocky Mountain juniper, ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, hackberry.	Siberian elm-----	Eastern cottonwood.
DuB----- Duroc	Lilac, American plum.	Rocky Mountain juniper, Siberian peashrub, skunkbush sumac, hackberry.	Ponderosa pine, honeylocust, eastern redcedar, Scotch pine, green ash.	Siberian elm-----	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Dv----- Duroc	American plum, Amur honeysuckle, lilac, skunkbush sumac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub, common chokecherry.	Ponderosa pine, honeylocust, green ash.	Siberian elm-----	---
Dx----- Duroc	Amur honeysuckle, lilac, American plum.	---	Rocky Mountain juniper, ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, hackberry.	Siberian elm-----	Eastern cottonwood.
DyE----- Dwyer	---	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Scotch pine.	---	---	---
ErE*: Epping.					
Mitchell-----	Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, hackberry, honeylocust, green ash.	Siberian elm-----	---	---
Gd----- Glenberg	American plum, fragrant sumac.	Siberian peashrub	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, hackberry, green ash, bur oak, Russian-olive.	Black locust-----	Eastern cottonwood.
Go----- Goshen	Lilac, American plum.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, green ash, hackberry, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
JmB, JmC----- Jayem	Siberian peashrub, skunkbush sumac, common chokecherry, Amur honeysuckle, lilac.	Eastern redcedar, Russian-olive, Rocky Mountain juniper.	Siberian elm, ponderosa pine, green ash, honeylocust.	---	---
Jo----- Johnstown	Skunkbush sumac, Peking cotoneaster, American plum.	Eastern redcedar, Siberian peashrub.	Ponderosa pine, bur oak, Russian- olive, honeylocust, green ash, hackberry.	Siberian elm-----	--

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ke, KeB, KeC----- Keith	Common chokecherry, American plum, lilac.	Hackberry, Manchurian crabapple, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub.	Ponderosa pine, honeylocust.	Siberian elm-----	---
Ku----- Kuma	Fragrant sumac, lilac, Amur honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, green ash, ponderosa pine, honeylocust, bur oak.	Siberian elm-----	---
Lm----- Las	Lilac, American plum.	Amur honeysuckle	Russian-olive, eastern redcedar, Rocky Mountain juniper, ponderosa pine, hackberry, green ash.	Siberian elm, honeylocust.	Eastern cottonwood.
Lw. Las Animas					
Ly----- Lodgepole	Lilac, American plum, common chokecherry.	---	Eastern redcedar, ponderosa pine, honeylocust, hackberry, green ash, Russian mulberry.	Silver maple, golden willow.	---
Mc----- McCook	American plum, lilac.	---	Eastern redcedar, honeylocust, Rocky Mountain juniper, hackberry, ponderosa pine, green ash, Russian-olive.	Siberian elm-----	Eastern cottonwood.
MkC, MkD, MkE----- Mitchell	Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, hackberry, honeylocust, green ash.	Siberian elm-----	---	---
Pg*. Pits					
ReG*: Rock outcrop.					
Epping.					
RhG*: Rock outcrop.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
RhG*: Tassel.					
Ro----- Rosebud	Siberian peashrub, skunkbush sumac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, hackberry, Russian-olive, green ash.	Honeylocust, Siberian elm, ponderosa pine.	---	---
RoB, RoC----- Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
RsD*: Rosebud-----	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Canyon.					
Sb, SbB, SbC----- Satanta	Amur honeysuckle, fragrant sumac, lilac.	Russian-olive, common chokecherry.	Honeylocust, green ash, ponderosa pine, hackberry, eastern redcedar, bur oak.	Siberian elm-----	---
SnC----- Sidney	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
SoD*: Sidney-----	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
Canyon.					
TbF*: Tassel.					
Busher-----	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine----	---	---
TcG*: Tassel.					
Busher.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
TcG*: Rock outcrop.					
UyB, UyC----- Ulysses	Fragrant sumac, Amur honeysuckle, lilac.	Eastern redcedar, common chokecherry.	Honeylocust, ponderosa pine, Russian-olive, green ash, bur oak.	Siberian elm-----	---
VdD----- Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine----	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ao----- Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AoB, AoC----- Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AtB, AtC----- Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AvD*: Altvan-----	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Dix-----	Slight-----	Slight-----	Severe: slope.	Slight.
Bb----- Bankard	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy, flooding.	Moderate: too sandy.
Bc----- Bankard	Severe: flooding.	Moderate: flooding, too sandy.	Severe: flooding.	Moderate: too sandy, flooding.
Be----- Bayard	Slight-----	Slight-----	Moderate: small stones.	Slight.
BeB, BeC----- Bayard	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
BeD----- Bayard	Slight-----	Slight-----	Severe: slope.	Slight.
BeE----- Bayard	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bg----- Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BgB, BgC----- Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
BgD----- Bridget	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
BuC----- Busher	Slight-----	Slight-----	Moderate: slope.	Slight.
BxD*: Busher-----	Slight-----	Slight-----	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BxD*: Tassel-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
ByE*: Busher-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tassel-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
CcF----- Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
CdG*: Canyon-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
CeE*: Canyon-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Bayard-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
CtB, CtC----- Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
DhD----- Dix	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: slope, small stones.	Moderate: dusty.
DhG----- Dix	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Du----- Duroc	Slight-----	Slight-----	Slight-----	Slight.
DuB----- Duroc	Slight-----	Slight-----	Moderate: slope.	Slight.
Dv, Dx----- Duroc	Slight-----	Slight-----	Slight-----	Slight.
DyE----- Dwyer	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ErE*: Epping-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Mitchell-----	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Gd----- Glenberg	Severe: flooding.	Slight-----	Moderate: small stones.	Slight.
Go----- Goshen	Severe: flooding.	Slight-----	Slight-----	Slight.
JmB, JmC----- Jayem	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
Jo----- Johnstown	Slight-----	Slight-----	Slight-----	Slight.
Ke----- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
KeB, KeC----- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ku----- Kuma	Slight-----	Slight-----	Slight-----	Slight.
Lm----- Las	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.
Lw----- Las Animas	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Ly----- Lodgepole	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
Mc----- McCook	Severe: flooding.	Slight-----	Slight-----	Slight.
MkC----- Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
MkD----- Mitchell	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
MkE----- Mitchell	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Pg*----- Pits	Severe: flooding, slope, small stones.	Severe: slope, too sandy, small stones.	Severe: slope, small stones, too sandy.	Severe: too sandy.
ReG*: Rock outcrop-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Epping-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
RhG*: Rock outcrop-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Tassel-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Ro----- Rosebud	Moderate: dusty.	Moderate: dusty.	Slight-----	Moderate: dusty.
RoB, RoC----- Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
RsD*: Rosebud-----	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Canyon-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Sb----- Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
SbB, SbC----- Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SnC----- Sidney	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SoD*: Sidney-----	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Canyon-----	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
TbF*: Tassel-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
TbF*: Busher-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
TcG*: Tassel-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Busher-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Rock outcrop-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
UyB, UyC----- Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
VdD----- Valent	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
Ao, AoB, AoC----- Alliance	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Poor	Good.
AtB----- Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AtC----- Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AvD*: Altvan-----	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Dix-----	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Bb----- Bankard	Poor	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Bc----- Bankard	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Be----- Bayard	Good	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
BeB, BeC----- Bayard	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
BeD----- Bayard	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
BeE----- Bayard	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Bg, BgB----- Bridget	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BgC, BgD----- Bridget	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BuC----- Busher	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
BxD*: Busher-----	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Tassel-----	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
ByE*: Busher-----	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tassel-----	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
CcF----- Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
CdG*: Canyon-----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CeE*: Canyon-----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Bayard-----	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
CtB----- Creighton	Good	Good	Fair	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair.
CtC----- Creighton	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Poor	Fair.
DhD----- Dix	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
DhG----- Dix	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Du, DuB----- Duroc	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Dv----- Duroc	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Dx----- Duroc	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
DyE----- Dwyer	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
ErE*: Epping-----	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Mitchell-----	Poor	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Gd----- Glenberg	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Go----- Goshen	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
JmB, JmC----- Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Jo----- Johnstown	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
Ke, KeB----- Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC----- Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Ku----- Kuma	Good	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
Lm----- Las	Fair	Fair	Fair	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Lw----- Las Animas	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ly----- Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.
Mc----- McCook	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
MkC, MkD----- Mitchell	Fair	Good	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Fair.
MkE----- Mitchell	Poor	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Pg*----- Pits	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Fair	Very poor.	Very poor.	Poor	Poor.
ReG*: Rock outcrop-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Epping-----	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
RhG*: Rock outcrop-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Tassel-----	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Ro----- Rosebud	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
RoB----- Rosebud	Good	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
RoC----- Rosebud	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
RsD*: Rosebud-----	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Canyon-----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
Sb, SbB, SbC----- Satanta	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
SnC----- Sidney	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
SoD*: Sidney-----	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Canyon-----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
TbF*: Tassel-----	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Busher-----	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
TcG*: Tassel-----	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Busher-----	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Rock outcrop-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
UyB----- Ulysses	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
UyC----- Ulysses	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
VdD----- Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ao, AoB----- Alliance	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: frost action.	Slight.
AoC----- Alliance	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
AtB----- Altvan	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
AtC----- Altvan	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
AvD*: Altvan-----	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
Dix-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
Bb----- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Bc----- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Be, BeB----- Bayard	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: frost action.	Slight.
BeC, BeD----- Bayard	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
BeE----- Bayard	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Bg, BgB----- Bridget	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: low strength.	Slight.
BgC, BgD----- Bridget	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength.	Slight.
BuC----- Busher	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
BxD*: Busher-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Tassel-----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ByE*:						
Busher-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Tassel-----	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
CcF-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
CdG*:						
Canyon-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
CeE*:						
Canyon-----	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
Bayard-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
CtB-----	Slight-----	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
Creighton						
CtC-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Creighton						
DhD-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Severe: droughty.
Dix						
DhG-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Dix						
Du, DuB-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
Duroc						
Dv-----	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell.	Severe: low strength.	Slight.
Duroc						
Dx-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
Duroc						
DyE-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Dwyer						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ErE*: Epping-----	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, shrink-swell, slope.	Severe: depth to rock.
Mitchell-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Gd----- Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: droughty.
Go----- Goshen	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
JmB----- Jayem	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
JmC----- Jayem	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Jo----- Johnstown	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Ke, KeB----- Keith	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: low strength, frost action.	Slight.
KeC----- Keith	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength, frost action.	Slight.
Ku----- Kuma	Slight-----	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell.	Severe: low strength.	Slight.
Lm----- Las	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Lw----- Las Animas	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
Ly----- Lodgepole	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Mc----- McCook	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
MkC, MkD----- Mitchell	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
MkE----- Mitchell	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pg*----- Pits	Severe: cutbanks cave, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: small stones, droughty, slope.
ReG*: Rock outcrop----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Epping-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
RhG*: Rock outcrop----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Tassel-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Ro, RoB----- Rosebud	Moderate: depth to rock.	Slight-----	Moderate: depth to rock.	Slight-----	Moderate: frost action.	Moderate: depth to rock.
RoC----- Rosebud	Moderate: depth to rock.	Slight-----	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: depth to rock.
RSD*: Rosebud-----	Moderate: depth to rock.	Slight-----	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: depth to rock.
Canyon-----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
Sb, SbB----- Satanta	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell.	Severe: low strength.	Slight.
SbC----- Satanta	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
SnC----- Sidney	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
SoD*: Sidney-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
Canyon-----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
TbF*: Tassel-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TbF*: Busher-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
TcG*: Tassel-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Busher-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
UyB----- Ulysses	Slight-----	Slight: shrink-swell.	Slight: shrink-swell.	Slight: shrink-swell.	Slight: shrink-swell, frost action.	Slight.
UyC----- Ulysses	Slight-----	Slight: shrink-swell.	Slight: shrink-swell.	Moderate: shrink-swell, slope.	Slight: shrink-swell, frost action.	Slight.
VdD----- Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ao----- Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight-----	Fair: depth to rock.
AoB, AoC----- Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight-----	Fair: depth to rock.
AtB, AtC----- Altvan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----	Poor: seepage, too sandy.
AvD*: Altvan-----	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----	Poor: seepage, too sandy.
Dix-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bb, Bc----- Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
Be, BeB, BeC----- Bayard	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
BeD----- Bayard	Slight-----	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
BeE----- Bayard	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Bg----- Bridget	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
BgB, BgC----- Bridget	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
BgD----- Bridget	Moderate: percs slowly.	Severe: slope.	Slight-----	Slight-----	Good.
BuC----- Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight-----	Fair: depth to rock, thin layer.
BxD*: Busher-----	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight-----	Fair: depth to rock, thin layer.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BxD*: Tassel-----	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Slight-----	Poor: depth to rock.
ByE*: Busher-----	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock.	Moderate: slope.	Fair: depth to rock, slope, thin layer.
Tassel-----	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
CcF----- Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
CdG*: Canyon-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
CeE*: Canyon-----	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
Bayard-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
CtB, CtC----- Creighton	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
DhD----- Dix	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
DhG----- Dix	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Du----- Duroc	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
DuB----- Duroc	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
Dv----- Duroc	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----	Fair: thin layer.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Dx----- Duroc	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
DyE----- Dwyer	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
ErE*: Epping-----	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
Mitchell-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Gd----- Glenberg	Moderate: flooding.	Severe: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
Go----- Goshen	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
JmB, JmC----- Jayem	Slight-----	Severe: seepage.	Moderate: too sandy.	Slight-----	Good.
Jo----- Johnstown	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----	Fair: too clayey, thin layer.
Ke----- Keith	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
KeB, KeC----- Keith	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
Ku----- Kuma	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Lm----- Las	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness, thin layer.
Lw----- Las Animas	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
Ly----- Lodgepole	Severe: wetness, percs slowly.	Severe: seepage.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Mc----- McCook	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Good.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MkC----- Mitchell	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
MkD----- Mitchell	Moderate: percs slowly.	Severe: slope.	Slight-----	Slight-----	Good.
MkE----- Mitchell	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Pg*----- Pits	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
ReG*: Rock outcrop-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Epping-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
RhG*: Rock outcrop-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Tassel-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Ro, RoB, RoC----- Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Poor: depth to rock.
RsD*: Rosebud-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Poor: depth to rock.
Canyon-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Poor: depth to rock.
Sb----- Satanta	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
SbB, SbC----- Satanta	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
SnC----- Sidney	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SoD*: Sidney-----	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.
Canyon-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Poor: depth to rock.
TbF*: Tassel-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Busher-----	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
TcG*: Tassel-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Busher-----	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Rock outcrop-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
UyB, UyC----- Ulysses	Slight: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
VdD----- Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ao, AoB, AoC----- Alliance	Fair: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AtB, AtC----- Altvan	Good-----	Probable-----	Probable-----	Fair: small stones, area reclaim, thin layer.
AvD*: Altvan-----	Good-----	Probable-----	Probable-----	Fair: small stones, area reclaim, thin layer.
Dix-----	Good-----	Probable-----	Probable-----	Poor: area reclaim, too sandy, small stones.
Bb, Bc----- Bankard	Good-----	Probable-----	Improbable: too sandy.	Poor: area reclaim, too sandy.
Be, BeB, BeC, BeD----- Bayard	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
BeE----- Bayard	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Bg, BgB, BgC, BgD----- Bridget	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BuC----- Busher	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
BxD*: Busher-----	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Tassel-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
ByE*: Busher-----	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Tassel-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CcF----- Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
CdG*: Canyon-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Rock outcrop-----	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
CeE*: Canyon-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Bayard-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
CtB, CtC----- Creighton	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
DhD----- Dix	Good-----	Probable-----	Probable-----	Poor: area reclaim, too sandy, small stones.
DhG----- Dix	Poor: slope.	Probable-----	Probable-----	Poor: area reclaim, too sandy, small stones.
Du, DuB----- Duroc	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Dv----- Duroc	Good-----	Probable-----	Probable-----	Fair: too clayey, area reclaim.
Dx----- Duroc	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
DyE----- Dwyer	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
ErE*: Epping-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Mitchell-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Gd----- Glenberg	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Go----- Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
JmB, JmC----- Jayem	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Jo----- Johnstown	Good-----	Probable-----	Probable-----	Good.
Ke, KeB, KeC----- Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ku----- Kuma	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lm----- Las	Fair: wetness.	Probable-----	Improbable: too sandy.	Fair: too clayey.
Lw----- Las Animas	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ly----- Lodgepole	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Mc----- McCook	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
MkC, MkD----- Mitchell	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
MkE----- Mitchell	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Pg*----- Pits	Fair: slope.	Probable-----	Probable-----	Poor: area reclaim, too sandy, small stones.
ReG*: Rock outcrop-----	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Epping-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
RhG*: Rock outcrop-----	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Tassel-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Ro, RoB, RoC----- Rosebud	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RsD*: Rosebud-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
Canyon-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Sb, SbB, SbC----- Satanta	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
SnC----- Sidney	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
SoD*: Sidney-----	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Canyon-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
TbF*: Tassel-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Busher-----	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
TcG*: Tassel-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Busher-----	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop-----	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
UyB, UyC----- Ulysses	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
VdD----- Valent	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ao, AoB----- Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Too arid, erodes easily.
AoC----- Alliance	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope-----	Erodes easily	Too arid, erodes easily.
AtB----- Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Favorable-----	Too sandy-----	Too arid.
AtC----- Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope-----	Too sandy-----	Too arid.
AvD*: Altvan-----	Severe: seepage.	Severe: seepage.	Deep to water	Slope-----	Too sandy-----	Too arid.
Dix-----	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Too arid, droughty.
Bb, Bc----- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
Be, BeB----- Bayard	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
BeC, BeD----- Bayard	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
BeE----- Bayard	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Bg, BgB----- Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Too arid, erodes easily.
BgC, BgD----- Bridget	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
BuC----- Busher	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
BxD*: Busher-----	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
Tassel-----	Severe: depth to rock.	Slight-----	Deep to water	Slope, soil blowing, depth to rock.	Depth to rock	Too arid.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ByE*: Busher-----	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Tassel-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
CcF----- Canyon	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock.	Too arid, slope.
CdG*: Canyon-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock.	Too arid, slope.
Rock outcrop----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
CeE*: Canyon-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock.	Too arid, slope.
Bayard-----	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
CtB----- Creighton	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Too arid, erodes easily.
CtC----- Creighton	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
DhD----- Dix	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy-----	Too arid, droughty.
DhG----- Dix	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Too arid, slope, droughty.
Du, DuB----- Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Dv----- Duroc	Severe: seepage.	Severe: piping.	Deep to water	Favorable-----	Favorable-----	Favorable.
Dx----- Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
DyE----- Dwyer	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ErE*:						
Epping-----	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Mitchell-----	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Gd----- Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Too sandy-----	Too arid, droughty.
Go----- Goshen	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
JmB----- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
JmC----- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
Jo----- Johnstown	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable-----	Favorable-----	Favorable.
Ke, KeB----- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Too arid, erodes easily.
KeC----- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope-----	Erodes easily	Too arid, erodes easily.
Ku----- Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Lm----- Las	Severe: seepage.	Severe: piping.	Flooding-----	Wetness, flooding.	Wetness-----	Favorable.
Lw----- Las Animas	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, droughty, rooting depth.	Wetness-----	Wetness, droughty, rooting depth.
Ly----- Lodgepole	Severe: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Mc----- McCook	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
MkC, MkD----- Mitchell	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Too arid, erodes easily.
MkE----- Mitchell	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Pg*----- Pits	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ReG*: Rock outcrop-----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Epping-----	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
RhG*: Rock outcrop-----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Tassel-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
Ro, RoB----- Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Too arid, depth to rock.
RoC----- Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock	Too arid, depth to rock.
RsD*: Rosebud-----	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock	Too arid, depth to rock.
Canyon-----	Severe: depth to rock.	Slight-----	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
Sb, SbB----- Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Favorable-----	Too arid.
SbC----- Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope-----	Favorable-----	Too arid.
SnC----- Sidney	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope-----	Favorable-----	Too arid.
SoD*: Sidney-----	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope-----	Favorable-----	Too arid.
Canyon-----	Severe: depth to rock.	Slight-----	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
TbF*: Tassel-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TbF*: Busher-----	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
TcG*: Tassel-----	Severe: depth to rock, slope.	Slight-----	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
Busher-----	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Rock outcrop----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
UyB----- Ulysses	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-----	Erodes easily	Too arid, erodes easily.
UyC----- Ulysses	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope-----	Erodes easily	Too arid, erodes easily.
VdD----- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ao, AoB, AoC----- Alliance	0-9	Loam-----	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	2-15
	9-21	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	15-25
	21-52	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	60-90	20-40	2-15
	52-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AtB, AtC----- Altvan	0-11	Loam-----	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	2-10
	11-21	Clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-80	25-40	5-15
	21-30	Loam, silt loam	ML, CL-ML	A-4	0	85-100	80-100	70-95	55-75	25-35	2-10
	30-34	Fine sandy loam	SM	A-4	0	85-100	80-100	60-85	35-50	20-25	NP-5
	34-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP-SM	A-1	0	60-95	55-90	25-60	5-10	---	NP
AvD*: Altvan-----	0-7	Loam-----	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	2-10
	7-26	Clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-80	25-40	5-15
	26-33	Loam, silt loam	ML, CL-ML	A-4	0	85-100	80-100	70-95	55-75	25-35	2-10
	33-37	Fine sandy loam	SM	A-4	0	85-100	80-100	60-85	35-50	20-25	NP-5
	37-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP-SM	A-1	0	60-95	55-90	25-60	5-10	---	NP
Dix-----	0-18	Sandy loam-----	SM, ML, SC, SC-SM	A-2, A-4, A-1	0	95-100	75-100	40-80	20-55	<30	NP-10
	18-60	Gravelly loamy coarse sand, very gravelly sand, very gravelly loamy coarse sand.	SP, SP-SM, SM, GP	A-1, A-2, A-3	0	40-90	30-85	15-60	4-25	---	NP
Bb----- Bankard	0-6	Loamy sand-----	SM	A-2	0	95-100	90-100	50-90	15-35	---	NP
	6-60	Stratified loamy fine sand to gravelly coarse sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	50-100	20-75	0-20	---	NP
Bc----- Bankard	0-11	Loamy fine sand	SM	A-2	0	95-100	90-100	50-90	15-35	<20	NP-5
	11-20	Stratified loamy fine sand to sand.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	<20	NP-5
	20-60	Stratified loamy fine sand to gravelly coarse sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	50-100	20-75	0-20	<20	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Be, BeB, BeC, BeD, BeE----- Bayard	0-12	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	45-85	25-55	20-40	3-10
	12-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	55-95	30-65	20-40	3-10
Bg, BgB, BgC, BgD----- Bridget	0-13	Very fine sandy loam.	ML, CL-ML, CL, SM	A-4	0	95-100	95-100	75-100	45-65	20-35	2-15
	13-19	Very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-15
	19-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-15
BuC----- Busher	0-11	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	11-56	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	56-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BxD*: Busher-----	0-19	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	19-45	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	45-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel-----	0-5	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	55-100	25-55	<25	NP-8
	5-17	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	95-100	80-100	65-95	25-60	<25	NP-8
	17-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ByE*: Busher-----	0-16	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	16-42	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ByE*: Tassel-----	0-6	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	6-18	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CcF----- Canyon	0-6	Fine sandy loam	SM, SC, SC-SM, ML	A-4, A-2	0-5	90-100	75-100	45-95	20-95	15-30	NP-10
	6-11	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-100	50-100	40-95	30-75	20-40	NP-15
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CdG*: Canyon-----	0-5	Fine sandy loam	SM, SC, SC-SM, ML	A-4, A-2	0-5	90-95	75-95	45-95	20-95	15-30	NP-10
	5-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CeE*: Canyon-----	0-6	Fine sandy loam	SM, SC, SC-SM, ML	A-4, A-2	0-5	90-95	75-95	45-95	20-95	15-30	NP-10
	6-11	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bayard-----	0-12	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	45-85	25-55	20-40	3-10
	12-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	55-95	30-65	20-40	3-10
CtB, CtC----- Creighton	0-10	Very fine sandy loam.	ML, CL-ML	A-4	0	100	90-100	85-100	50-65	<25	NP-5
	10-30	Very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	<30	NP-10
	30-60	Very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	<30	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DhD, DhG----- Dix	0-11	Gravelly loam----	SM, GM	A-4, A-2	0	50-80	50-75	40-70	30-50	<35	NP-10
	11-19	Gravelly loamy coarse sand, very gravelly sand, very gravelly loamy coarse sand.	SP, SP-SM, SM, GP	A-1, A-2, A-3	0	40-90	30-85	15-60	4-20	---	NP
	19-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
Du, DuB----- Duroc	0-6	Loam-----	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
	6-19	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	19-60	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
Dv----- Duroc	0-10	Loam-----	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
	10-29	Clay loam, loam	CL	A-6	0	100	95-100	80-100	60-80	25-40	11-25
	29-49	Loam-----	ML, CL-ML	A-4	0	100	95-100	75-100	55-75	20-30	2-10
	49-60	Gravelly sand----	SP, SP-SM	A-1	0	55-80	50-75	25-45	0-10	---	NP
Dx----- Duroc	0-8	Silt loam-----	CL, CL-ML	A-6, A-4	0	100	100	90-100	70-100	25-35	5-15
	8-41	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	41-60	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
DyE----- Dwyer	0-4	Loamy fine sand	SM	A-2	0	100	100	65-80	20-35	<25	NP
	4-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2	0	85-100	75-100	50-80	5-35	---	NP
ErE*: Epping-----	0-5	Loam-----	ML, CL, CL-ML	A-4, A-6	0	100	95-100	75-100	55-80	15-35	2-15
	5-13	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mitchell-----	0-4	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-95	20-35	NP-10
	4-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	95-100	85-100	60-100	20-35	NP-15
Gd----- Glenberg	0-6	Fine sandy loam	SM, SC-SM	A-4, A-2	0	95-100	85-100	60-80	30-45	15-25	NP-7
	6-60	Stratified fine sand to loam.	SM, SC-SM	A-2, A-4	0	90-100	75-100	50-70	25-40	15-20	NP-5
Go----- Goshen	0-12	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	20-40	3-20
	12-44	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	8-22
	44-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
JmB, JmC----- Jayem	0-19	Fine sandy loam	SM	A-4, A-2	0	100	85-100	55-95	25-50	<25	NP-5
	19-30	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	<25	NP-5
	30-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	<25	NP-5
Jo----- Johnstown	0-9	Loam-----	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	20-40	3-18
	9-22	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	80-95	30-50	15-30
	22-46	Silty clay loam, silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	50-95	20-40	5-20
	46-60	Gravelly coarse sand, coarse sand, sand.	SM, SP-SM	A-1, A-2, A-3	0	60-100	50-95	25-70	5-15	---	NP
Ke, KeB, KeC----- Keith	0-10	Loam-----	CL, ML, CL-ML	A-4	0	100	100	85-100	80-100	20-35	2-10
	10-23	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	80-100	30-45	10-25
	23-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	2-12
Ku----- Kuma	0-7	Loam-----	ML	A-4	0	100	95-100	90-100	75-95	25-35	NP-10
	7-42	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-45	10-25
	42-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	90-100	70-95	20-40	NP-20
Lm----- Las	0-4	Loam-----	CL, CL-ML	A-4, A-6	0	100	100	90-100	50-85	20-40	5-20
	4-60	Clay loam, loam, sandy loam.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	50-85	22-45	5-25
Lw----- Las Animas	0-5	Loam-----	CL-ML	A-4	0	100	95-100	80-95	60-90	25-30	5-10
	5-60	Stratified very fine sandy loam to loamy fine sand.	SM, ML	A-2, A-4	0	95-100	90-100	55-90	25-55	20-25	NP-5
Ly----- Lodgepole	0-9	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	20-40	3-20
	9-47	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	90-100	85-95	50-65	25-40
	47-58	Silt loam, very fine sandy loam, loam.	CL, CL-ML, ML	A-4	0	100	100	90-100	60-90	20-35	3-10
	58-60	Sandy loam, fine sandy loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	70-90	15-60	<20	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct						
Mc----- McCook	0-12	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	50-80	15-25	NP-10
	12-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	80-100	50-100	15-45	NP-15
MkC, MkD, MkE---- Mitchell	0-5	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-95	20-35	NP-10
	5-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	95-100	85-100	60-100	20-35	NP-15
Pg*----- Pits	0-60	Gravelly sand----	SP, SP-SM, SM, GP-GM	A-1, A-2, A-3	0-5	45-100	40-100	0-80	0-40	---	NP
ReG*: Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Epping-----	0-4	Loam-----	ML, CL, CL-ML	A-4, A-6	0	100	95-100	75-100	55-80	15-35	2-15
	4-10	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	10-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RhG*: Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tassel-----	0-6	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	6-12	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ro, RoB, RoC----- Rosebud	0-4	Loam-----	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	24-34	3-12
	4-15	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	60-95	30-50	12-26
	15-30	Sandy loam, very fine sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RsD*: Rosebud-----	0-4	Loam-----	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	24-34	3-12
	4-17	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	60-85	30-50	12-26
	17-33	Sandy loam, very fine sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RsD*: Canyon-----	0-8	Loam-----	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	8-15	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sb, SbB, SbC----- Satanta	0-10	Loam-----	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-95	55-75	20-35	2-15
	10-18	Clay loam, loam	CL	A-6, A-7-6	0	100	95-100	85-100	60-75	30-45	10-25
	18-56	Loam, fine sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-6, A-2	0	90-100	85-100	60-95	30-75	20-35	2-15
	56-60	Gravelly loamy sand, gravelly sandy loam.	SM, GM, SP-SM, GP-GM	A-1, A-2-4	0	55-80	50-75	25-50	10-30	---	NP
SnC----- Sidney	0-7	Loam-----	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	7-19	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	19-50	Loam, very fine sandy loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	80-100	60-100	35-85	20-40	2-15
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SoD*: Sidney-----	0-7	Loam-----	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	7-18	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	18-50	Loam, very fine sandy loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	80-100	60-100	35-85	20-40	2-15
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon-----	0-6	Loam-----	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	6-11	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
TbF*: Tassel-----	0-6	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	6-13	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TbF*: Busher-----	0-18	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	18-55	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	55-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
TcG*: Tassel-----	0-8	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	8-14	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Busher-----	0-10	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	10-42	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
UyB, UyC----- Ulysses	0-12	Loam-----	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	3-15
	12-24	Loam, very fine sandy loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	50-85	25-40	4-15
	24-60	Loam, very fine sandy loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	50-85	25-40	4-15
VdD----- Valent	0-6	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	<25	NP-5
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ao, AoB, AoC----- Alliance	0-9	15-20	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low-----	0.28	5	5	2-4
	9-21	25-35	1.15-1.30	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	21-52	15-25	1.20-1.40	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low-----	0.43			
	52-60	---	---	0.2-0.6	---	---	---	---	---			
AtB, AtC----- Altvan	0-11	16-23	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-----	0.28	4	5	1-2
	11-21	20-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.32			
	21-30	18-25	1.25-1.50	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-----	0.32			
	30-34	8-15	1.30-1.50	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low-----	0.24			
	34-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-8.4	<2	Low-----	0.10			
AvD*: Altvan-----	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-----	0.28	4	5	1-2
	7-26	20-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.32			
	26-33	18-25	1.25-1.50	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-----	0.32			
	33-37	8-15	1.30-1.50	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low-----	0.24			
	37-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-8.4	<2	Low-----	0.10			
Dix-----	0-18	7-18	1.30-1.50	2.0-6.0	0.13-0.18	6.1-7.8	<2	Low-----	0.20	2	3	1-2
	18-60	2-10	1.70-1.90	6.0-20	0.04-0.07	6.6-8.4	<2	Low-----	0.05			
Bb----- Bankard	0-6	2-10	1.80-1.95	6.0-20	0.10-0.15	7.4-8.4	<2	Low-----	0.17	5	2	.5-1
	6-60	0-10	1.85-2.00	6.0-20	0.07-0.14	7.4-9.0	<2	Low-----	0.17			
Bc----- Bankard	0-11	2-10	1.80-1.95	6.0-20	0.10-0.15	7.4-8.4	<2	Low-----	0.17	5	2	.5-2
	11-20	0-10	1.85-2.00	6.0-20	0.07-0.15	7.4-8.4	<2	Low-----	0.17			
	20-60	0-10	1.85-2.00	6.0-20	0.07-0.14	7.4-8.4	<2	Low-----	0.17			
Be, BeB, BeC, BeD, BeE----- Bayard	0-12	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	<2	Low-----	0.20	5	3	1-3
	12-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.20			
Bg, BgB, BgC, BgD----- Bridget	0-13	5-18	1.30-1.50	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-----	0.32	5	3	1-3
	13-19	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	<2	Low-----	0.43			
	19-60	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	<2	Low-----	0.43			
BuC----- Busher	0-11	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low-----	0.20	5	3	1-2
	11-56	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low-----	0.28			
	56-60	---	---	0.2-0.6	---	---	---	---	---			
BxD*: Busher-----	0-19	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low-----	0.20	5	3	1-2
	19-45	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low-----	0.28			
	45-60	---	---	0.2-0.6	---	---	---	---	---			
Tassel-----	0-5	5-12	1.30-1.50	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low-----	0.24	2	3	.5-3
	5-17	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24			
	17-60	---	---	0.2-0.6	---	---	---	---	---			
ByE*: Busher-----	0-16	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low-----	0.20	5	3	1-2
	16-42	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low-----	0.28			
	42-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
ByE*:												
Tassel-----	0-6	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24	2	2	.5-3
	6-18	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24			
	18-60	---	---	0.2-0.6	---	---	---	---	---			
CcF-----	0-6	5-15	1.30-1.50	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low-----	0.24	2	3	.5-2
Canyon	6-11	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-----	0.20			
	11-60	---	---	0.2-0.6	---	---	---	---	---			
CdG*:												
Canyon-----	0-5	5-15	1.30-1.50	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low-----	0.24	2	3	.5-2
	5-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-----	0.20			
	14-60	---	---	0.2-0.6	---	---	---	---	---			
Rock outcrop----	0-60	---	---	---	---	---	<2	---	---	---	8	---
CeE*:												
Canyon-----	0-6	5-15	1.30-1.50	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low-----	0.24	2	3	.5-2
	6-11	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-----	0.20			
	11-60	---	---	0.2-0.6	---	---	---	---	---			
Bayard-----	0-12	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	<2	Low-----	0.20	5	3	1-3
	12-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.20			
CtB, CtC-----	0-10	5-15	1.25-1.35	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low-----	0.32	5	3	1-3
Creighton	10-30	5-18	1.30-1.40	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-----	0.43			
	30-60	5-18	1.30-1.40	0.6-2.0	0.15-0.17	7.9-9.0	0-2	Low-----	0.43			
DhD, DhG-----	0-11	5-20	1.60-1.80	0.6-2.0	0.12-0.18	6.1-7.8	<2	Low-----	0.15	2	8	1-2
Dix	11-19	2-10	1.70-1.90	6.0-20	0.04-0.06	6.6-8.4	<2	Low-----	0.05			
	19-60	0-3	1.70-2.00	>20	0.02-0.04	6.6-8.4	<2	Low-----	0.05			
Du, DuB-----	0-6	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	<2	Moderate	0.28	5	5	1-3
Duroc	6-19	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate	0.43			
	19-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	<2	Moderate	0.43			
Dv-----	0-10	15-25	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-----	0.28	5	5	1-3
Duroc	10-29	20-35	1.20-1.50	0.6-2.0	0.17-0.19	6.6-7.8	<2	Moderate	0.28			
	29-49	10-25	1.30-1.50	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low-----	0.32			
	49-60	0-5	1.50-1.70	>20	0.03-0.06	7.4-9.0	<2	Low-----	0.10			
Dx-----	0-8	15-20	1.20-1.45	0.6-2.0	0.14-0.23	6.6-7.8	<2	Moderate	0.32	5	5	1-3
Duroc	8-41	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate	0.43			
	41-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	<2	Moderate	0.43			
DyE-----	0-4	3-8	1.35-1.45	6.0-20	0.10-0.12	6.6-8.4	<2	Low-----	0.17	5	2	1-2
Dwyer	4-60	1-8	1.45-1.55	6.0-20	0.06-0.11	7.4-8.4	<2	Low-----	0.17			
ErE*:												
Epping-----	0-5	10-20	1.20-1.45	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low-----	0.37	2	4L	.5-2
	5-13	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low-----	0.43			
	13-60	---	---	0.06-0.2	---	---	---	---	---			
Mitchell-----	0-4	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-----	0.43	5	3	.5-2
	4-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	<2	Low-----	0.43			
Gd-----	0-6	8-20	1.30-1.50	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low-----	0.24	5	3	.5-2
Glenberg	6-60	8-15	1.50-1.60	2.0-6.0	0.07-0.16	7.4-8.4	<2	Low-----	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Go----- Goshen	0-12	16-25	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low-----	0.32	5	5	2-4
	12-44	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	44-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-----	0.43			
JmB, JmC----- Jayem	0-19	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low-----	0.20	5	3	1-3
	19-30	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low-----	0.32			
	30-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low-----	0.32			
Jo----- Johnstown	0-9	20-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	<2	Moderate	0.28	5	6	2-4
	9-22	27-35	1.40-1.50	0.6-2.0	0.15-0.20	6.1-7.8	<2	Moderate	0.32			
	22-46	15-32	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	46-60	2-5	1.50-1.70	>6.0	0.02-0.04	6.6-7.8	<2	Low-----	0.10			
Ke, KeB, KeC----- Keith	0-10	14-20	1.25-1.45	0.6-2.0	0.20-0.23	6.1-7.3	<2	Low-----	0.28	5	5	2-4
	10-23	18-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-7.8	<2	Moderate	0.43			
	23-60	8-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-----	0.43			
Ku----- Kuma	0-7	15-27	1.20-1.30	0.6-2.0	0.18-0.21	6.1-8.4	<2	Low-----	0.32	5	5	2-4
	7-42	18-35	1.25-1.35	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	0.37			
	42-60	10-30	1.40-1.50	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low-----	0.32			
Lm----- Las	0-4	15-27	1.30-1.45	0.6-2.0	0.17-0.22	7.4-8.4	0-4	Moderate	0.32	5	4L	.5-1
	4-60	18-35	1.30-1.50	0.2-0.6	0.15-0.19	7.4-8.4	0-4	Moderate	0.32			
Lw----- Las Animas	0-5	15-25	1.35-1.55	0.6-2.0	0.15-0.20	7.4-8.4	<4	Low-----	0.32	5	4L	.5-2
	5-60	8-18	1.55-1.75	2.0-6.0	0.06-0.12	7.4-8.4	<4	Low-----	0.24			
Ly----- Lodgepole	0-9	16-25	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.8	<2	Low-----	0.37	3	6	2-4
	9-47	35-50	1.25-1.50	<0.06	0.13-0.18	6.1-7.8	<2	High-----	0.28			
	47-58	8-27	1.30-1.50	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low-----	0.43			
	58-60	5-20	1.40-1.50	2.0-6.0	0.10-0.18	6.6-8.4	<2	Low-----	0.17			
Mc----- McCook	0-12	10-18	1.20-1.50	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low-----	0.32	5	3	1-3
	12-60	10-18	1.20-1.50	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-----	0.32			
MkC, MkD, MkE----- Mitchell	0-5	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-----	0.43	5	3	.5-2
	5-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	<2	Low-----	0.43			
Pg*----- Pits	0-60	0-8	1.70-2.00	>6.0	0.02-0.09	6.6-8.4	<2	Low-----	0.10	2	8	<.5
ReG*: Rock outcrop----	0-60	---	---	---	---	---	<2	---	---	---	8	---
Epping-----	0-4	10-20	1.20-1.45	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low-----	0.37	2	4L	.5-2
	4-10	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low-----	0.43			
	10-60	---	---	0.06-0.2	---	---	---	---	---			
RhG*: Rock outcrop----	0-60	---	---	---	---	---	<2	---	---	---	8	---
Tassel-----	0-6	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24	2	2	.5-3
	6-12	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24			
	12-60	---	---	0.2-0.6	---	---	---	---	---			
Ro, RoB, RoC----- Rosebud	0-4	8-20	1.20-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low-----	0.28	4	5	2-4
	4-15	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	15-30	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-9.0	<2	Low-----	0.28			
	30-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
RsD*:												
Rosebud-----	0-4	8-20	1.20-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low-----	0.28	4	5	2-4
	4-17	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	17-33	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-9.0	<2	Low-----	0.28			
	33-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon-----	0-8	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-----	0.32	2	4L	.5-2
	8-15	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-----	0.20			
	15-60	---	---	0.2-0.6	---	---	---	---	---			
Sb, SbB, SbC-----	0-10	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-----	0.28	5	6	1-2
Satanta	10-18	18-35	1.35-1.45	0.6-2.0	0.17-0.19	6.6-7.8	<2	Moderate	0.28			
	18-56	10-27	1.30-1.50	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low-----	0.28			
	56-60	2-15	1.50-1.70	6.0-20	0.02-0.04	7.4-8.4	<2	Low-----	0.10			
SnC-----	0-7	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-----	0.28	5	4L	1-3
Sidney	7-19	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-----	0.28			
	19-50	5-20	1.20-1.50	0.6-2.0	0.12-0.19	7.4-9.0	<2	Low-----	0.28			
	50-60	---	---	0.2-0.6	---	---	---	---	---			
SoD*:												
Sidney-----	0-7	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-----	0.28	5	4L	1-3
	7-18	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-----	0.28			
	18-50	5-20	1.20-1.50	0.6-2.0	0.12-0.19	7.4-9.0	<2	Low-----	0.28			
	50-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon-----	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-----	0.32	2	4L	.5-2
	6-11	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-----	0.20			
	11-60	---	---	0.2-0.6	---	---	---	---	---			
TbF*:												
Tassel-----	0-6	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24	2	2	.5-3
	6-13	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24			
	13-60	---	---	0.2-0.6	---	---	---	---	---			
Busher-----	0-18	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low-----	0.20	5	3	1-2
	18-55	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low-----	0.28			
	55-60	---	---	0.2-0.6	---	---	---	---	---			
TcG*:												
Tassel-----	0-8	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24	2	2	.5-3
	8-14	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-----	0.24			
	14-60	---	---	0.2-0.6	---	---	---	---	---			
Busher-----	0-10	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low-----	0.20	5	3	1-2
	10-42	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low-----	0.28			
	42-60	---	---	0.2-0.6	---	---	---	---	---			
Rock outcrop----	0-60	---	---	---	---	---	<2	---	---	---	8	---
UyB, UyC-----	0-12	15-20	1.20-1.40	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low-----	0.28	5	5	1-3
Ulysses	12-24	18-27	1.20-1.40	0.6-2.0	0.10-0.19	7.4-8.4	<2	Low-----	0.43			
	24-60	18-27	1.20-1.40	0.6-2.0	0.10-0.19	7.9-8.4	<2	Low-----	0.43			
VdD-----	0-6	3-10	1.55-1.65	6.0-20	0.07-0.12	6.6-7.8	<2	Low-----	0.17	5	2	.5-1
Valent	6-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low-----	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "very brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>				
Ao, AoB, AoC----- Alliance	B	None-----	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
AtB, AtC----- Altvan	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
AvD*: Altvan-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
Dix-----	A	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Bb----- Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low-----	Moderate	Low.
Bc----- Bankard	A	Frequent---	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Be, BeB, BeC, BeD, BeE----- Bayard	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
Bg, BgB, BgC, BgD- Bridget	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
BuC----- Busher	B	None-----	---	---	>6.0	---	---	40-60	Soft	Low-----	Low-----	Low.
BxD*, ByE*: Busher-----	B	None-----	---	---	>6.0	---	---	40-60	Soft	Low-----	Low-----	Low.
Tassel-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
CcF----- Canyon	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
CdG*: Canyon-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
Rock outcrop----	D	None-----	---	---	>6.0	---	---	0	Soft	---	---	---
CeE*: Canyon-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months	Depth In	Hardness		Uncoated steel	Concrete
CeE*: Bayard-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
CtB, CtC----- Creighton	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High-----	Low.
DhD, DhG----- Dix	A	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Du, DuB----- Duroc	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Dv----- Duroc	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
Dx----- Duroc	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
DyE----- Dwyer	A	None-----	---	---	>6.0	---	---	>60	---	Low-----	High-----	Low.
ErE*: Epping-----	D	None-----	---	---	>6.0	---	---	10-20	Soft	Low-----	Low-----	Low.
Mitchell-----	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Gd----- Glenberg	B	Rare-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
Go----- Goshen	B	Rare-----	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
JmB, JmC----- Jayem	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate	Low.
Jo----- Johnstown	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ke, KeB, KeC----- Keith	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ku----- Kuma	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Lm----- Las	C	Occasional	Very brief	Apr-Sep	2.0-3.0	Apparent	Mar-Jun	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months	Depth In	Hardness		Uncoated steel	Concrete
Lw----- Las Animas	D	Frequent----	Long-----	Mar-Aug	0-1.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Moderate.
Ly----- Lodgepole	D	None-----	---	---	0-1.0	Perched	Mar-Jul	>60	---	High-----	High-----	Low.
Mc----- McCook	B	Rare-----	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
MkC, MkD, MkE----- Mitchell	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
Pg*----- Pits	A	Rare-----	---	---	>6.0	---	---	>60	---	Low-----	Low-----	Low.
ReG*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---	0	Soft	---	---	---
Epping-----	D	None-----	---	---	>6.0	---	---	10-20	Soft	Low-----	Low-----	Low.
RhG*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---	0	Soft	---	---	---
Tassel-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
Ro, RoB, RoC----- Rosebud	B	None-----	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
RsD*: Rosebud-----	B	None-----	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
Canyon-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
Sb, SbB, SbC----- Satanta	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low-----	Low.
SnC----- Sidney	B	None-----	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
SoD*: Sidney-----	B	None-----	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Canyon-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
TbF*: Tassel-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>				
TbF*: Busher-----	B	None-----	---	---	>6.0	---	---	40-60	Soft	Low-----	Low-----	Low.
TcG*: Tassel-----	D	None-----	---	---	>6.0	---	---	6-20	Soft	Low-----	Low-----	Low.
Busher-----	B	None-----	---	---	>6.0	---	---	40-60	Soft	Low-----	Low-----	Low.
Rock outcrop----	D	None-----	---	---	>6.0	---	---	0	Soft	---	---	---
UyB, UyC----- Ulysses	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate	Low.
VdD----- Valent	A	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name, report number, horizon, and depth in inches	Classifi- cation		Grain-size distribution						LL	PI	Specific gravity
			Percentage passing sieve--				Percentage smaller than--				
	AASHTO*	Uni- fied	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
									Pct		
Alliance loam**: (S83NE-033-044)											
Ap----- 0 to 6	A-4(8)	CL	100	99	97	86	70	21	31	10	2.56
Bt1----- 9 to 17	A-7-6 (13)	CL	100	100	99	94	79	29	42	21	2.59
C----- 27 to 47	A-4(8)	ML	100	99	96	81	63	11	27	4	2.62
Alliance loam**: (S85NE-033-054)											
Ap----- 0 to 7	A-4(8)	CL- ML	100	100	98	88	70	20	28	5	2.61
Bt1----- 7 to 13	A-6(11)	CL	100	100	99	94	85	29	39	18	2.62
C----- 33 to 45	A-4(8)	ML	100	99	98	90	80	11	26	2	2.64
Canyon fine sandy loam**: (S84NE-033-117)											
A----- 0 to 3	A-4(2)	SM	99	98	86	46	34	6	31	2	2.56
C----- 6 to 11	A-4(1)	SM	100	99	86	41	33	10	34	NP	2.59
Duroc loam**: (S81NE-033-044)											
Ap----- 0 to 6	A-4(7)	CL- ML	100	100	98	70	54	14	25	4	2.58
A3----- 19 to 33	A-6(10)	CL	100	100	100	90	75	27	38	16	2.59
AC----- 49 to 57	A-6(9)	CL	100	100	100	90	79	19	35	13	2.62
Jayem fine sandy loam**: (S81NE-033-049)											
Ap----- 0 to 5	A-2-4 (0)	SM	100	100	92	31	17	6	18	NP	2.63
AC----- 20 to 30	A-2-4 (1)	SM	100	100	89	25	13	3	18	NP	2.67
C1----- 30 to 54	A-4(1)	SM	100	100	94	41	21	4	19	1	2.66
Kuma loam**: (S84NE-033-120)											
Ap----- 0 to 7	A-4(8)	CL	100	100	100	91	75	20	33	10	2.57
Bt1----- 11 to 19	A-6(10)	CL	100	100	99	91	79	20	36	14	2.57
C1----- 29 to 38	A-4(8)	CL- ML	100	100	100	91	75	12	29	5	2.58

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classifi- cation		Grain-size distribution						LL	PI	Specific gravity
			Percentage passing sieve--				Percentage smaller than--				
	AASHTO*	Uni- fied	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
									Pct		
Kuma loam**: (S85NE-033-051)											
Ap----- 0 to 7	A-4(8)	ML	100	100	100	91	77	15	25	NP	2.62
Bt----- 7 to 14	A-6(10)	CL	100	100	100	92	79	24	34	14	2.64
Btb1--- 14 to 24	A-4(8)	CL	100	100	100	91	78	20	33	10	2.65
C2----- 56 to 74	A-4(8)	ML	100	100	100	90	73	7	25	1	2.66
Rosebud loam**: (S83NE-033-042)											
Ap----- 0 to 6	A-6(9)	CL	100	100	95	82	66	18	34	13	2.59
Bt2----- 10 to 13	A-7-6 (16)	CL	100	100	99	92	82	34	48	25	2.67
C----- 18 to 23	A-6(10)	CL	99	98	93	81	71	19	38	14	2.66
Rosebud loam**: (S85NE-033-055)											
Ap----- 0 to 4	A-4(7)	ML	100	100	94	72	59	8	26	1	2.64
Bt2----- 9 to 15	A-6(10)	CL	100	100	96	84	73	23	36	15	2.65
Bk2----- 20 to 30	A-4(8)	CL	100	99	95	83	72	18	32	9	2.65

* The group index number is computed by the modified system.

** Locations of the sampled pedons are as follows:

Alliance loam (S83NE-033-044), 2,000 feet east and 150 feet south of the northwest corner of sec. 27, T. 15 N., R. 52 W.
 Alliance loam (S85NE-033-054), 1,300 feet east and 370 feet south of the northwest corner of sec. 27, T. 15 N., R. 52 W.
 Canyon fine sandy loam, 2,050 feet east and 150 feet south of the northwest corner of sec. 19, T. 14 N., R. 51 W.
 Duroc loam, 1,200 feet south and 220 feet east of the northwest corner of sec. 18, T. 16 N., R. 48 W.
 Jayem fine sandy loam, 300 feet west and 200 feet south of the northeast corner of sec. 25, T. 16 N., R. 49 W.
 Kuma loam (S84NE-033-120), 700 feet south and 150 feet west of the northeast corner of sec. 27, T. 16 N., R. 50 W.
 Kuma loam (S85NE-033-051), 2,300 feet west and 275 feet south of the northeast corner of sec. 26, T. 16 N., R. 50 W.
 Rosebud loam (S83NE-033-042), 300 feet east and 100 feet north of the southwest corner of sec. 17, T. 13 N., R. 52 W.
 Rosebud loam (S85NE-033-055), 425 feet north and 75 feet west of the southeast corner of sec. 36, T. 14 N., R. 53 W.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alliance-----	Fine-silty, mixed, mesic Aridic Argiustolls
Altvan-----	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Bankard-----	Sandy, mixed, mesic Ustic Torrifluvents
Bayard-----	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Bridget-----	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Busher-----	Coarse-loamy, mixed, mesic Aridic Haplustolls
Canyon-----	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Creighton-----	Coarse-loamy, mixed, mesic Aridic Haplustolls
Dix-----	Sandy-skeletal, mixed, mesic Torriorthentic Haplustolls
Duroc-----	Fine-silty, mixed, mesic Pachic Haplustolls
Dwyer-----	Mixed, mesic Ustic Torripsamments
Epping-----	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
*Glenberg-----	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Goshen-----	Fine-silty, mixed, mesic Pachic Argiustolls
Jayem-----	Coarse-loamy, mixed, mesic Aridic Haplustolls
Johnstown-----	Fine-silty, mixed, mesic Pachic Argiustolls
Keith-----	Fine-silty, mixed, mesic Aridic Argiustolls
Kuma-----	Fine-silty, mixed, mesic Pachic Argiustolls
Las-----	Fine-loamy, mixed (calcareous), mesic Aquic Ustifluvents
Las Animas-----	Coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents
*Lodgepole-----	Fine, montmorillonitic, mesic Typic Argiaquolls
McCook-----	Coarse-silty, mixed, mesic Fluventic Haplustolls
*Mitchell-----	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Rosebud-----	Fine-loamy, mixed, mesic Aridic Argiustolls
Satanta-----	Fine-loamy, mixed, mesic Aridic Argiustolls
Sidney-----	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Tassel-----	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Ulysses-----	Fine-silty, mixed, mesic Aridic Haplustolls
Valent-----	Mixed, mesic Ustic Torripsamments

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability*		Prime farmland**	Range site	Windbreak suitability group
	N	I			
Ao----- Alliance	IIc-1	I-4	Yes	Silty-----	3
AoB----- Alliance	IIe-1	IIe-4	Yes	Silty-----	3
AoC----- Alliance	IIIe-1	IIIe-4	Yes	Silty-----	3
AtB----- Altvan	IIIe-1	IIIe-7	Yes	Silty-----	6G
AtC----- Altvan	IVe-1	IVe-7	Yes	Silty-----	6G
AvD----- Altvan----- Dix-----	IVe-1	IVe-7	---	Silty----- Shallow to Gravel----	6G 10
Bb----- Bankard	IVe-5	IVe-11	---	Sandy Lowland-----	7
Bc----- Bankard	VIw-7	---	---	Shallow to Gravel----	10
Be----- Bayard	IIe-3	IIe-8	Yes	Sandy-----	5
BeB----- Bayard	IIIe-3	IIe-8	Yes	Sandy-----	5
BeC----- Bayard	IVe-3	IIIe-8	Yes	Sandy-----	5
BeD----- Bayard	IVe-3	IVe-8	---	Sandy-----	5
BeE----- Bayard	VIe-3	---	---	Sandy-----	7
Bg----- Bridget	IIc-1	IIe-6	Yes	Silty-----	3
BgB----- Bridget	IIe-3	IIe-6	Yes	Silty-----	3
BgC----- Bridget	IIIe-3	IIIe-6	Yes	Silty-----	3
BgD----- Bridget	IVe-3	IVe-6	---	Silty-----	3
BuC----- Busher	IIIe-3	IIIe-8	Yes	Sandy-----	5
BxD----- Busher----- Tassel-----	IVe-3	IVe-8	---	Sandy----- Shallow Limy-----	5 10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability*		Prime farmland**	Range site	Windbreak suitability group
	N	I			
ByE----- Busher----- Tassel-----	VIe-3	---	---	Sandy----- Shallow Limy-----	7 10
CcF----- Canyon	Vis-4	---	---	Shallow Limy-----	10
CdG----- Canyon----- Rock outcrop.	VIIIs-4	---	---	Shallow Limy-----	10
CeE----- Canyon----- Bayard-----	Vis-4	---	---	Shallow Limy----- Sandy-----	10 10
CtB----- Creighton	IIe-3	IIe-6	Yes	Silty-----	3
CtC----- Creighton	IIIe-3	IIIe-6	Yes	Silty-----	3
DhD----- Dix	Vis-4	---	---	Shallow to Gravel---	10
DhG----- Dix	VIIIs-4	---	---	Shallow to Gravel---	10
Du----- Duroc	IIC-1	I-6	Yes	Silty-----	1
DuB----- Duroc	IIe-1	IIe-6	Yes	Silty-----	3
Dv----- Duroc	IIIC-1	I-6	Yes	Silty-----	3
Dx----- Duroc	IIIC-1	I-6	Yes	Silty-----	1
DyE----- Dwyer	VIe-5	---	---	Sands-----	7
ErE----- Epping----- Mitchell-----	Vis-4	---	---	Shallow Limy----- Limy Upland-----	10 8
Gd----- Glenberg	IIIe-3	IIe-8	Yes	Sandy Lowland-----	1L
Go----- Goshen	IIC-1	I-4	Yes	Silty-----	1
JmB----- Jayem	IIIe-3	IIe-8	Yes	Sandy-----	5
JmC----- Jayem	IVe-3	IIIe-8	Yes	Sandy-----	5
Jo----- Johnstown	IIC-1	I-4	Yes	Silty-----	3

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability*		Prime farmland**	Range site	Windbreak suitability group
	N	I			
Ke----- Keith	IIC-1	I-4	Yes	Silty-----	3
KeB----- Keith	IIe-1	IIe-4	Yes	Silty-----	3
KeC----- Keith	IIIe-1	IIIe-4	Yes	Silty-----	3
Ku----- Kuma	IIC-1	I-4	Yes	Silty-----	3
Lm----- Las	IVw-4	IIw-6	Yes	Subirrigated-----	2S
Lw----- Las Animas	Vw-7	---	---	Wetland-----	10
Ly----- Lodgepole	IIIw-2	IVw-2	---	Clayey Overflow-----	10
Mc----- McCook	IIC-1	IIe-5	Yes	Silty Lowland-----	1L
MkC----- Mitchell	IIIe-3	IIIe-6	---	Limy Upland-----	8
MkD----- Mitchell	IVe-3	IVe-6	---	Limy Upland-----	8
MkE----- Mitchell	VIe-3	---	---	Limy Upland-----	8
Pg----- Pits	VIIIIs-8	---	---	---	---
ReG----- Rock outcrop. Epping-----	VIIIs-4	---	---	Shallow Limy-----	10
RhG----- Rock outcrop. Tassel-----	VIIIs-4	---	---	Shallow Limy-----	10
Ro----- Rosebud	IIIC-1	I-4	Yes	Silty-----	6R
RoB----- Rosebud	IIIe-1	IIIe-4	Yes	Silty-----	6R
RoC----- Rosebud	IVe-1	IIIe-4	Yes	Silty-----	6R
RsD----- Rosebud----- Canyon-----	IVe-1	---	---	Silty----- Shallow Limy-----	6R 10
Sb----- Satanta	IIC-1	I-4	Yes	Silty-----	3

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability*		Prime farmland**	Range site	Windbreak suitability group
	N	I			
SbB----- Satanta	IIE-1	IIE-4	Yes	Silty-----	3
SbC----- Satanta	IIIE-1	IIIE-4	Yes	Silty-----	3
SnC----- Sidney	IIIE-1	IIIE-6	Yes	Silty-----	3
SoD----- Sidney----- Canyon-----	IVE-1	---	---	Silty----- Shallow Limy-----	3 10
TbF----- Tassel----- Busher-----	VIIs-4	---	---	Shallow Limy----- Sandy-----	10 10
TcG----- Tassel----- Busher----- Rock outcrop.	VIIs-4	---	---	Shallow Limy----- Savannah-----	10 10
UyB----- Ulysses	IIE-1	IIE-6	Yes	Silty-----	3
UyC----- Ulysses	IIIE-1	IIIE-6	Yes	Silty-----	3
VdD----- Valent	VIe-5	IVe-11	---	Sands-----	7

* A complex is treated as a single management unit in the land capability and prime farmland columns. The N column is for nonirrigated soils; the I column is for irrigated soils.

** Where irrigated.

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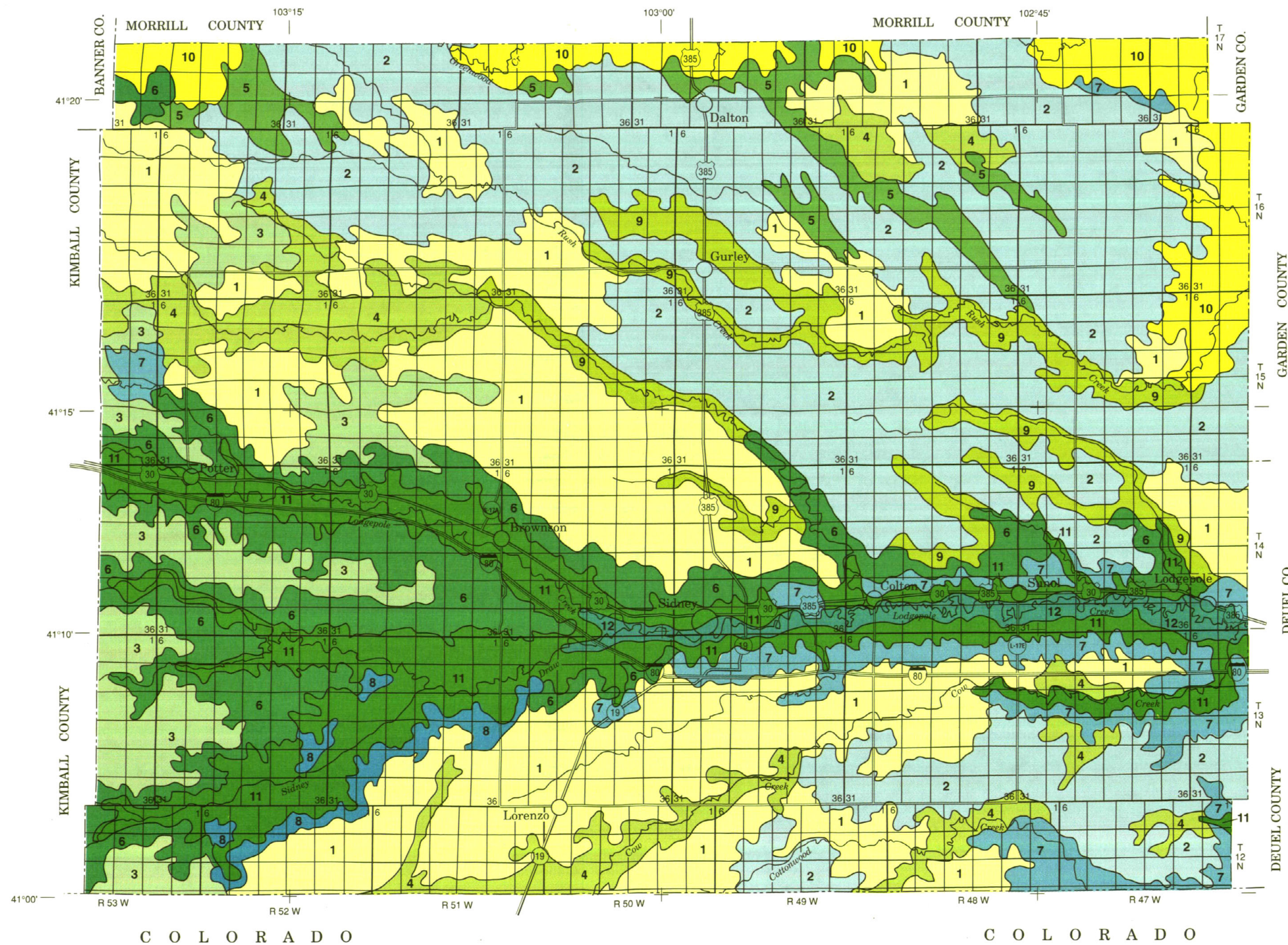
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- (2) fax: (202) 690-7442; or
- (3) email: program.intake@usda.gov.

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SOIL LEGEND*

- 1 ALLIANCE-DUROC-KUMA association
- 2 KUMA-KEITH-DUROC association
- 3 ROSEBUD-SIDNEY-CANYON association
- 4 ALTVAN-SATANTA-JOHNSTOWN association
- 5 JAYEM-DUROC-KEITH association
- 6 CANYON-BAYARD-ROSEBUD association
- 7 DIX-ALTVAN association
- 8 MITCHELL-EPPING-ROCK OUTCROP association
- 9 ALLIANCE-CANYON-SIDNEY association
- 10 BUSHER-TASSEL association
- 11 BAYARD-BRIDGET-DUROC association
- 12 LAS-GLENBERG-McCOOK association

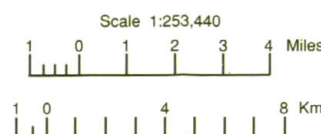
*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1994

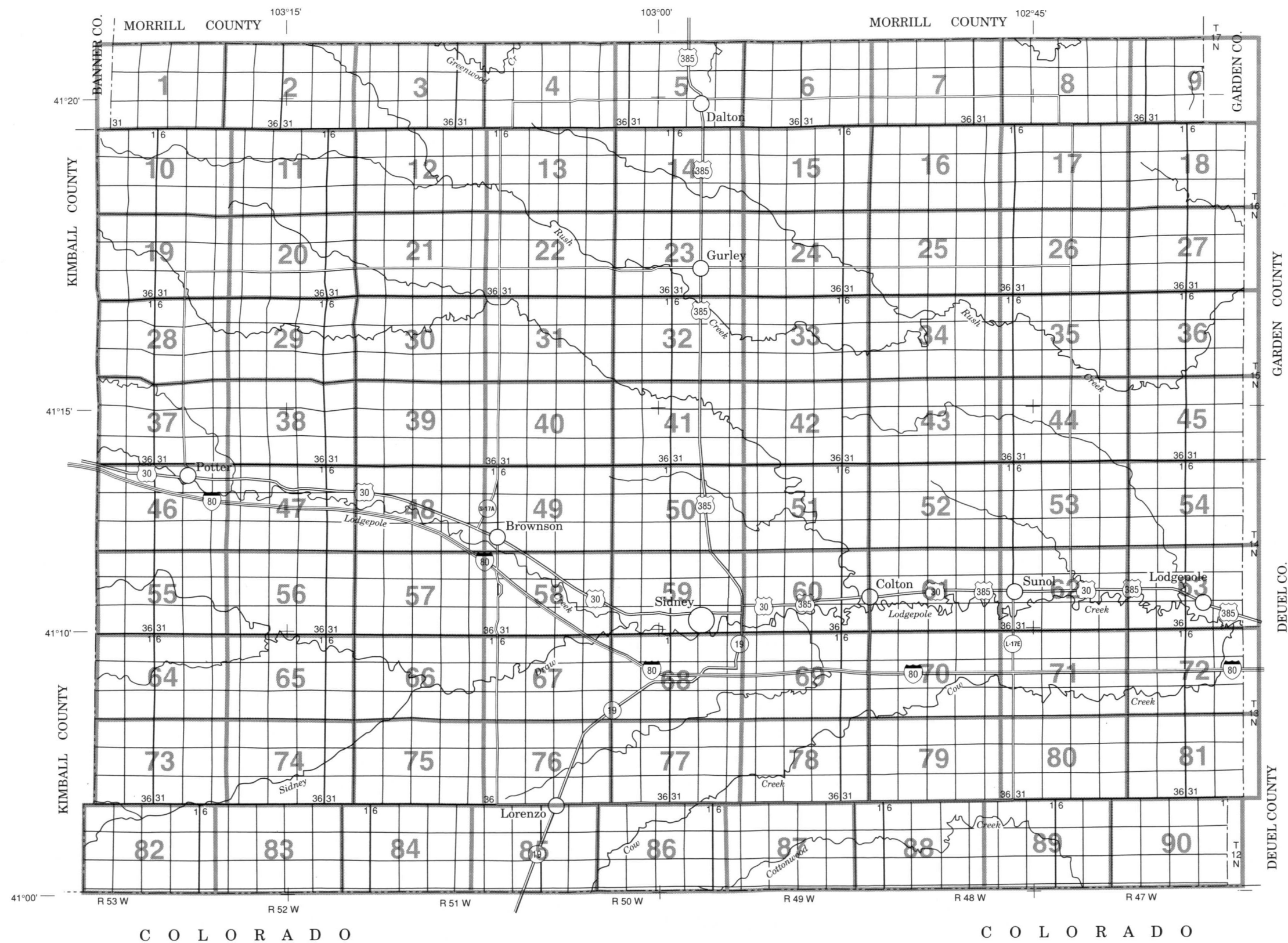
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA
CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

CHEYENNE COUNTY, NEBRASKA



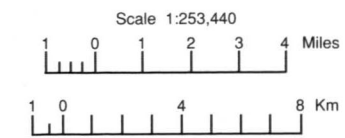
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED
TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS CHEYENNE COUNTY, NEBRASKA



SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
Ao	Alliance loam, 0 to 1 percent slopes
AoB	Alliance loam, 1 to 3 percent slopes
AoC	Alliance loam, 3 to 6 percent slopes
AtB	Altvan loam, 1 to 3 percent slopes
AtC	Altvan loam, 3 to 6 percent slopes
AvD	Altvan-Dix complex, 3 to 9 percent slopes
Bb	Bankard loamy sand, 0 to 2 percent slopes
Bc	Bankard loamy fine sand, channeled
Be	Bayard fine sandy loam, 0 to 1 percent slopes
BeB	Bayard fine sandy loam, 1 to 3 percent slopes
BeC	Bayard fine sandy loam, 3 to 6 percent slopes
BeD	Bayard fine sandy loam, 6 to 9 percent slopes
BeE	Bayard fine sandy loam, 9 to 20 percent slopes
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes
BgD	Bridget very fine sandy loam, 6 to 9 percent slopes
BuG	Busher fine sandy loam, 3 to 6 percent slopes
BxD	Busher-Tassel complex, 3 to 9 percent slopes
ByE	Busher-Tassel complex, 9 to 20 percent slopes
CcF	Canyon fine sandy loam, 6 to 30 percent slopes
CdG	Canyon-Rock outcrop complex, 11 to 60 percent slopes
CeE	Canyon-Bayard complex, 6 to 20 percent slopes
CtB	Creighton very fine sandy loam, 1 to 3 percent slopes
CtC	Creighton very fine sandy loam, 3 to 6 percent slopes
DhD	Dix gravelly loam, 3 to 11 percent slopes
DhG	Dix gravelly loam, 11 to 50 percent slopes
Du	Duroc loam, 0 to 1 percent slopes
DuB	Duroc loam, 1 to 3 percent slopes
Dv	Duroc loam, terrace, gravelly substratum, 0 to 1 percent slopes
Dx	Duroc silt loam, terrace, 0 to 1 percent slopes
DyE	Dwyer loamy fine sand, 9 to 17 percent slopes
ErE	Epping-Mitchell complex, 3 to 20 percent slopes
Gd	Glenberg fine sandy loam, 0 to 2 percent slopes
Go	Goshen silt loam, 0 to 1 percent slopes
JmB	Jayem fine sandy loam, 1 to 3 percent slopes
JmC	Jayem fine sandy loam, 3 to 6 percent slopes
Jo	Johnstown loam, 0 to 1 percent slopes
Ke	Keith loam, 0 to 1 percent slopes
KeB	Keith loam, 1 to 3 percent slopes
KeC	Keith loam, 3 to 6 percent slopes
Ku	Kuma loam, 0 to 1 percent slopes
Lm	Las loam, 0 to 1 percent slopes
Lw	Las Animas loam, 0 to 2 percent slopes
Ly	Lodgepole silt loam, 0 to 1 percent slopes
Mc	McCook very fine sandy loam, 0 to 1 percent slopes
MkC	Mitchell very fine sandy loam, 3 to 6 percent slopes
MkD	Mitchell very fine sandy loam, 6 to 9 percent slopes
MkE	Mitchell very fine sandy loam, 9 to 20 percent slopes
Pg	Pits, sand and Gravel
ReG	Rock outcrop-Epping complex, 11 to 60 percent slopes
RhG	Rock outcrop-Tassel complex, 20 to 60 percent slopes
Ro	Rosebud loam, 0 to 1 percent slopes
RoB	Rosebud loam, 1 to 3 percent slopes
RoC	Rosebud loam, 3 to 6 percent slopes
RsD	Rosebud-Canyon complex, 3 to 9 percent slopes
Sb	Satanta loam, gravelly substratum, 0 to 1 percent slopes
SbB	Satanta loam, gravelly substratum, 1 to 3 percent slopes
SbC	Satanta loam, gravelly substratum, 3 to 6 percent slopes
SnC	Sidney loam, 3 to 6 percent slopes
SoD	Sidney-Canyon complex, 3 to 9 percent slopes
TbF	Tassel-Busher complex, 3 to 30 percent slopes
TcG	Tassel-Busher-rock outcrop complex, 11 to 60 percent slopes
UyB	Ulysses loam, 1 to 3 percent slopes
UyC	Ulysses loam, 3 to 6 percent slopes
VdD	Valent loamy fine sand, 6 to 9 percent slopes

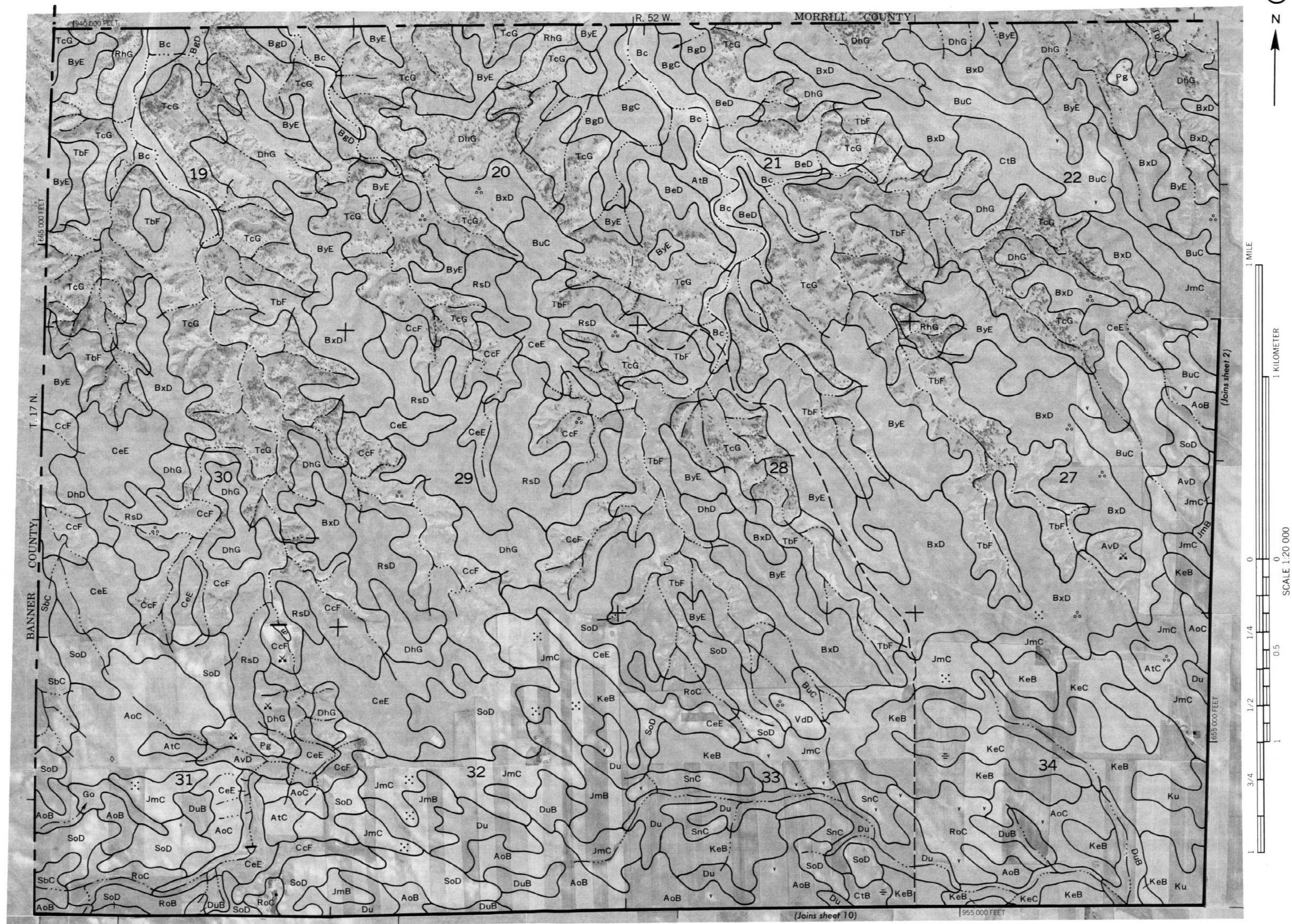
CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

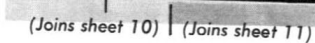
CULTURAL FEATURES		
BOUNDARIES	National, state, or province	
	County	
	Field sheet matchline and neatline	
	AD HOC BOUNDARY (label)	
Small airport, airfield, park, cemetery, or flood pool		
STATE COORDINATE TICK		
LAND DIVISION CORNER (sections and land grants)		
ROADS	Divided (median shown if scale permits)	
	Other roads	
	Trail	
ROAD EMBLEM & DESIGNATIONS		
Interstate		
Federal		
State		
County, farm or ranch		
RAILROAD		
DAMS	Large (to scale)	
	Medium or Small	
PITS		
Gravel pit (up to 5 acres)		
MISCELLANEOUS CULTURAL FEATURES		
Farmstead, house (omit in urban area)		

Church	
School	
Located object (label)	Tower

WATER FEATURES	
DRAINAGE	
Perennial, single line	
Intermittent	
Drainage end	
LAKES, PONDS AND RESERVOIRS	
Perennial	
MISCELLANEOUS WATER FEATURES	
Marsh (up to 5 acres)	
SPECIAL SYMBOLS FOR SOIL SURVEY	
SOIL DELINEATIONS AND SYMBOLS	
GULLY	
DEPRESSION (up to 3 acres)	
MISCELLANEOUS	
Blowout (up to 5 acres)	
Gravelly spot (up to 3 acres)	
Gumbo, slick or scabby spot (sodic) (up to 3 acres)	
Rock outcrop (up to 2 acres) (includes sandstone and shale)	
Sandy spot (up to 3 acres)	
Severely eroded spot (up to 3 acres)	
Calcareous spot (up to 3 acres)	

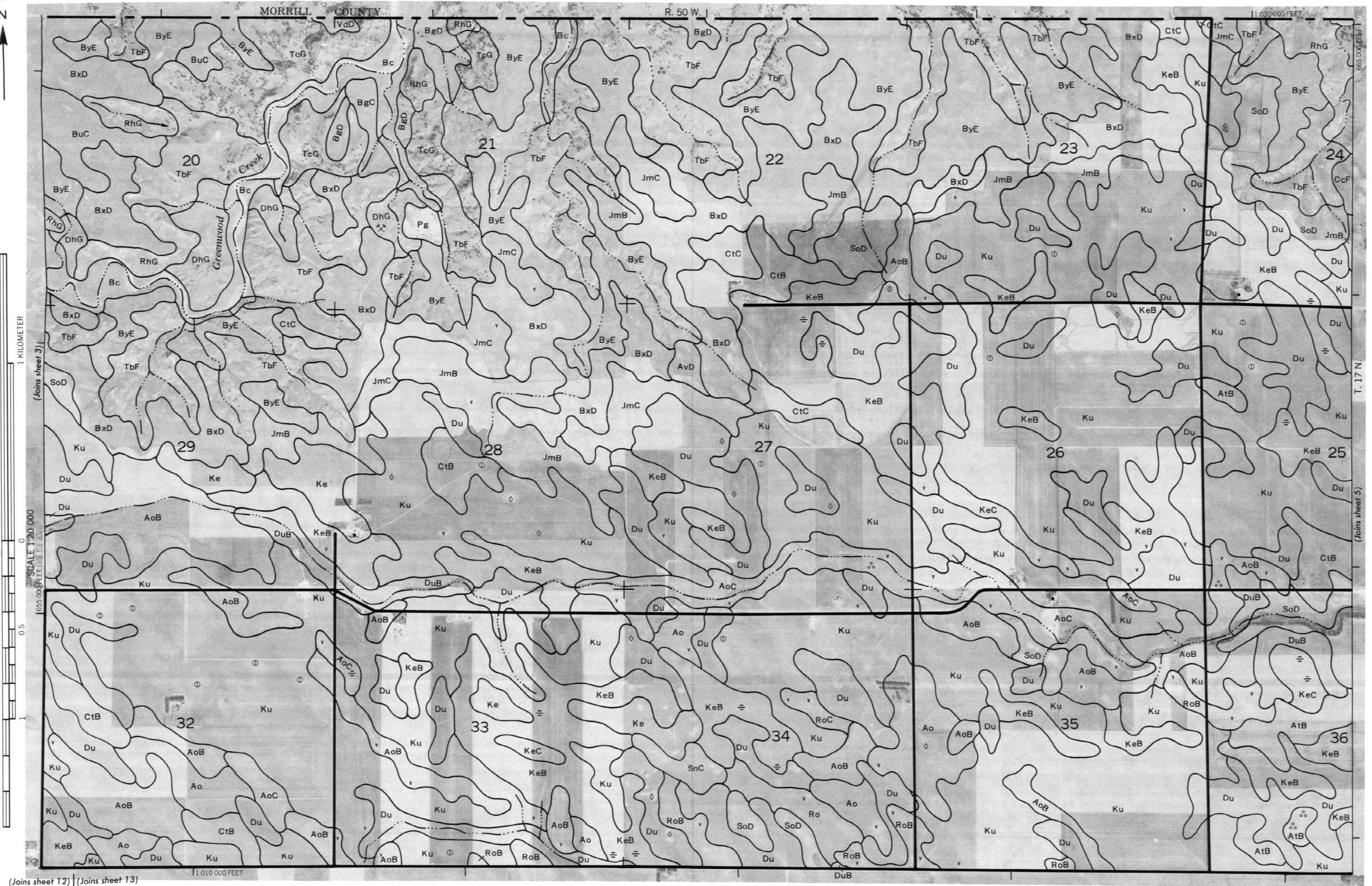
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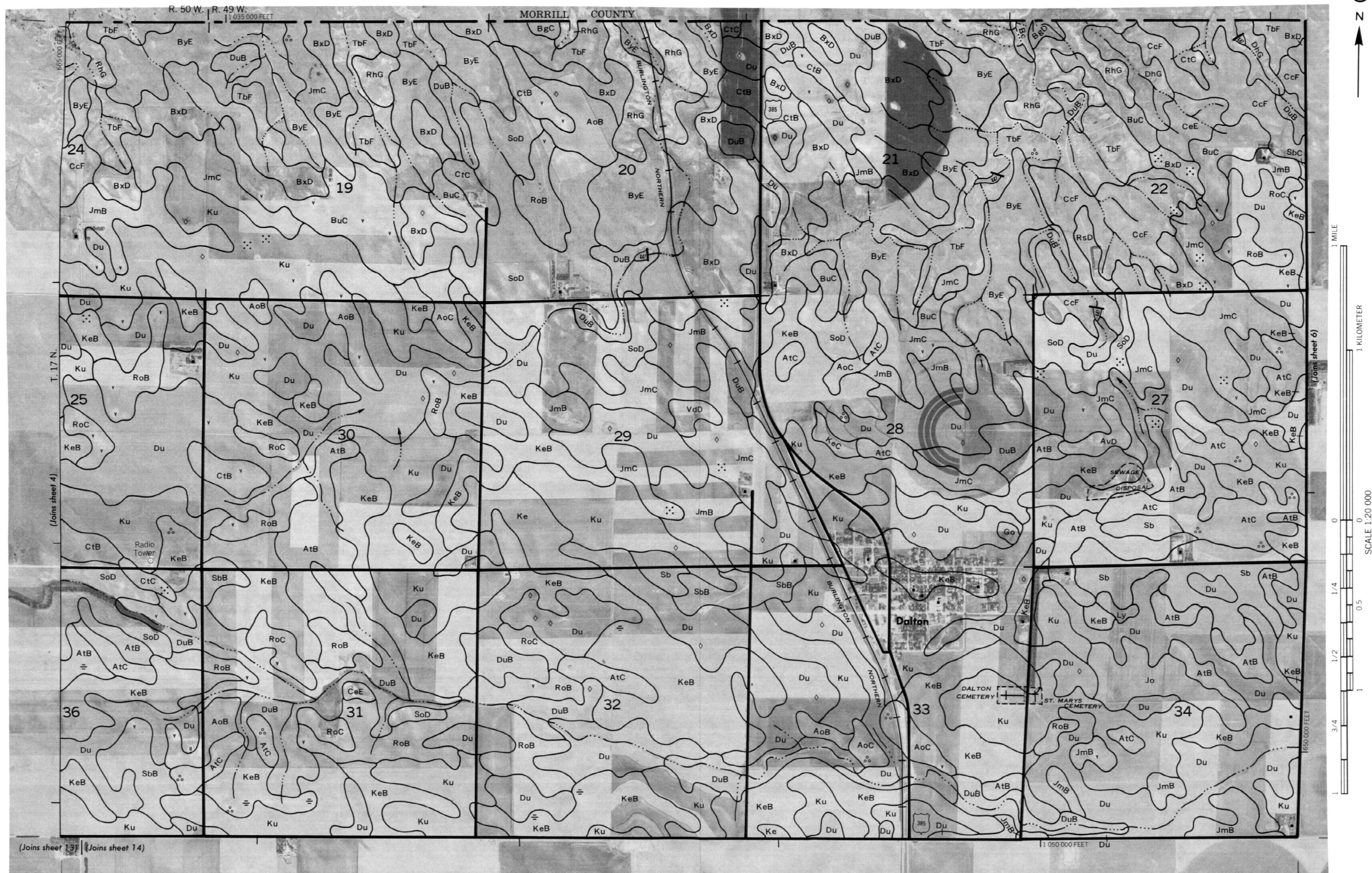


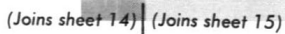
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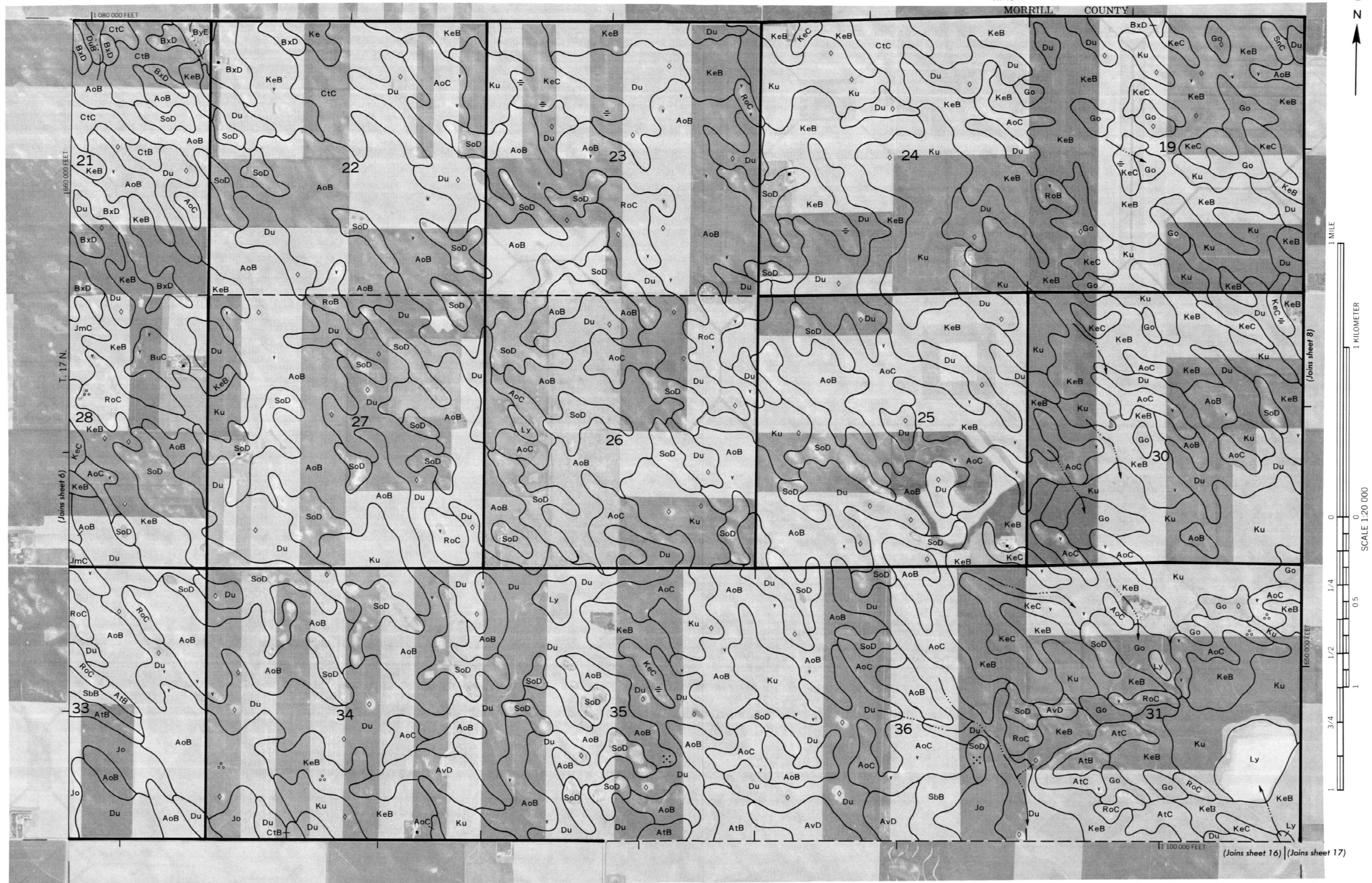


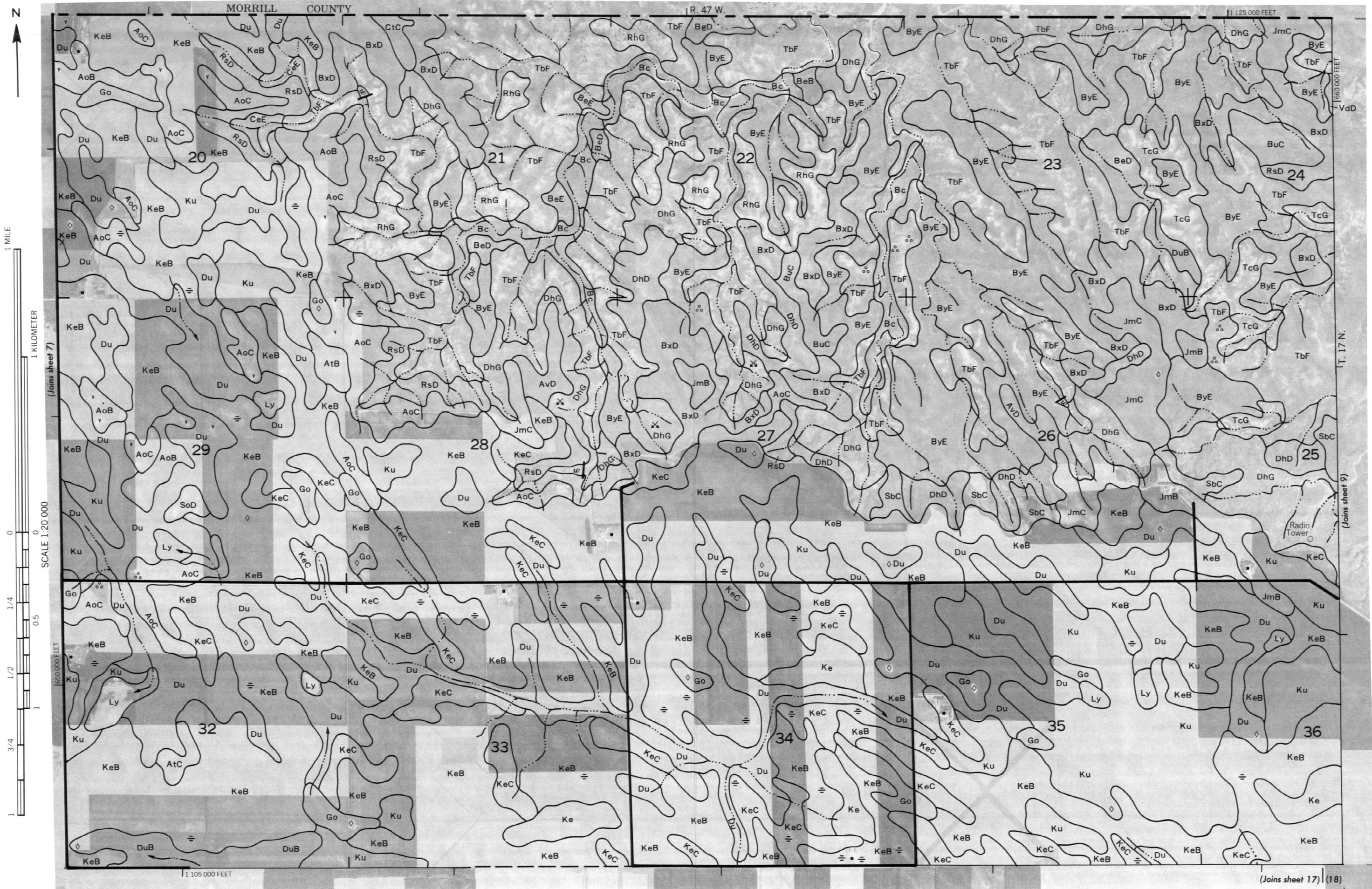
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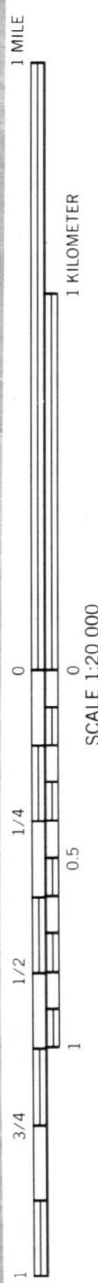




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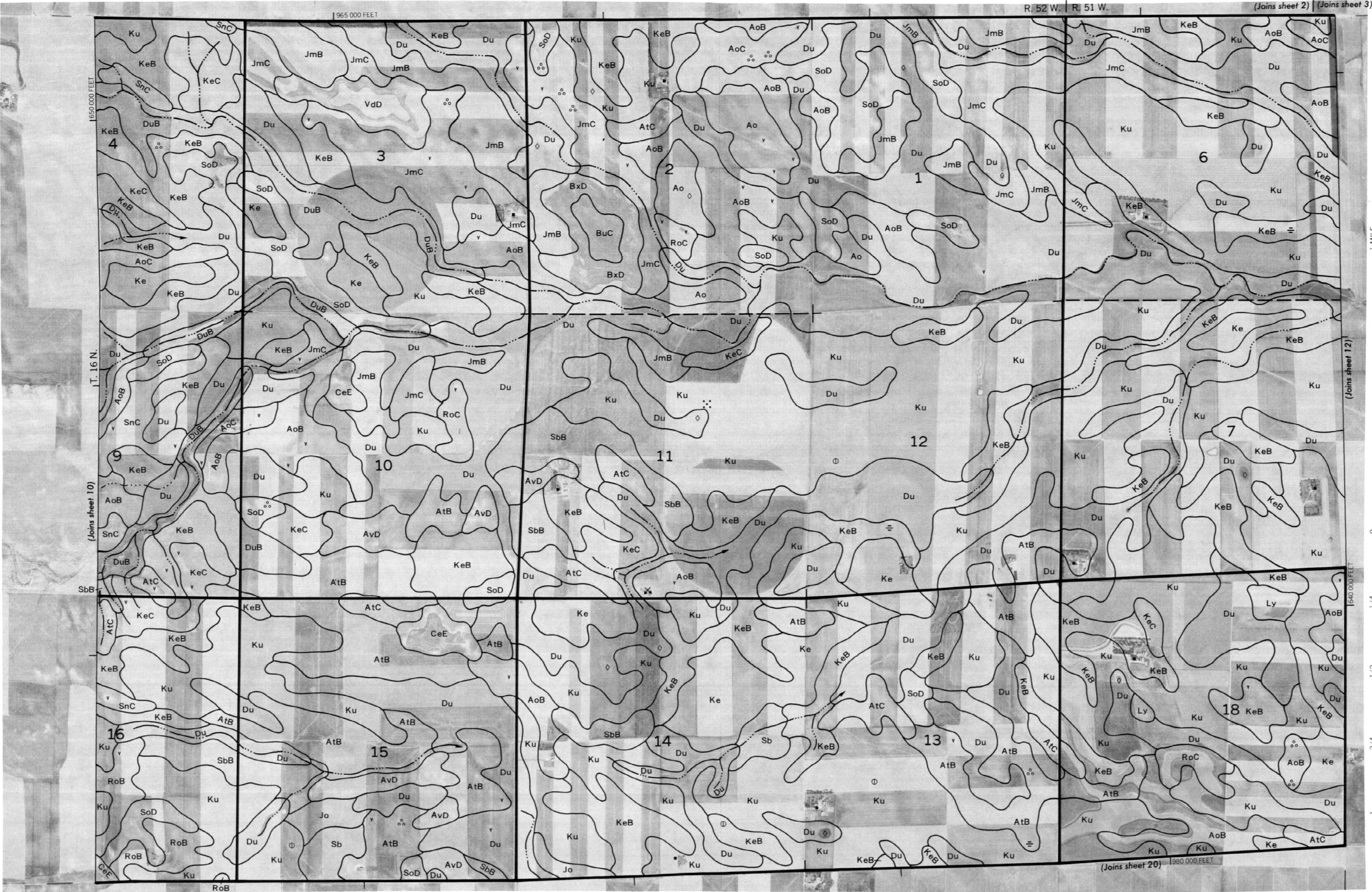


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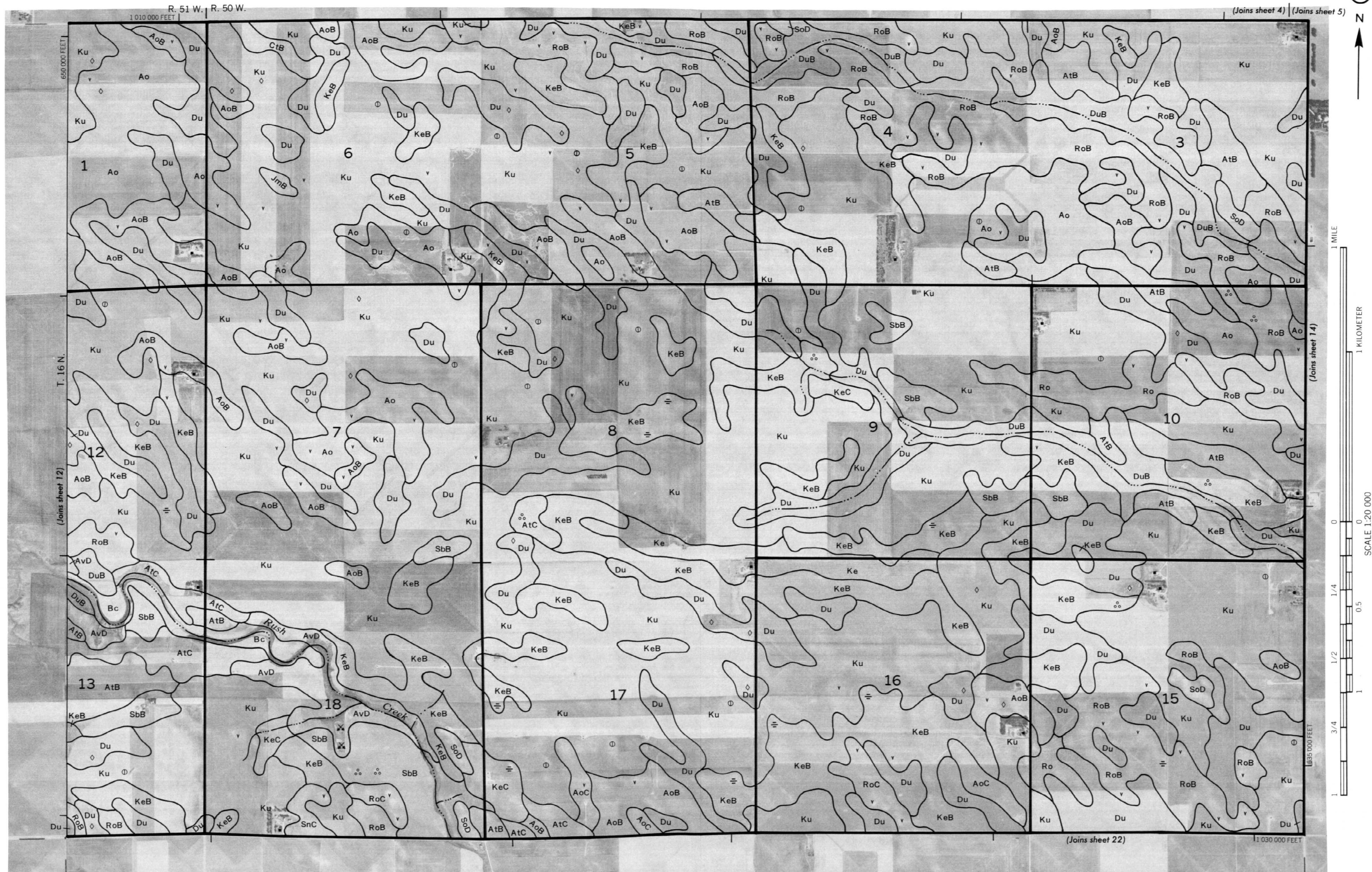
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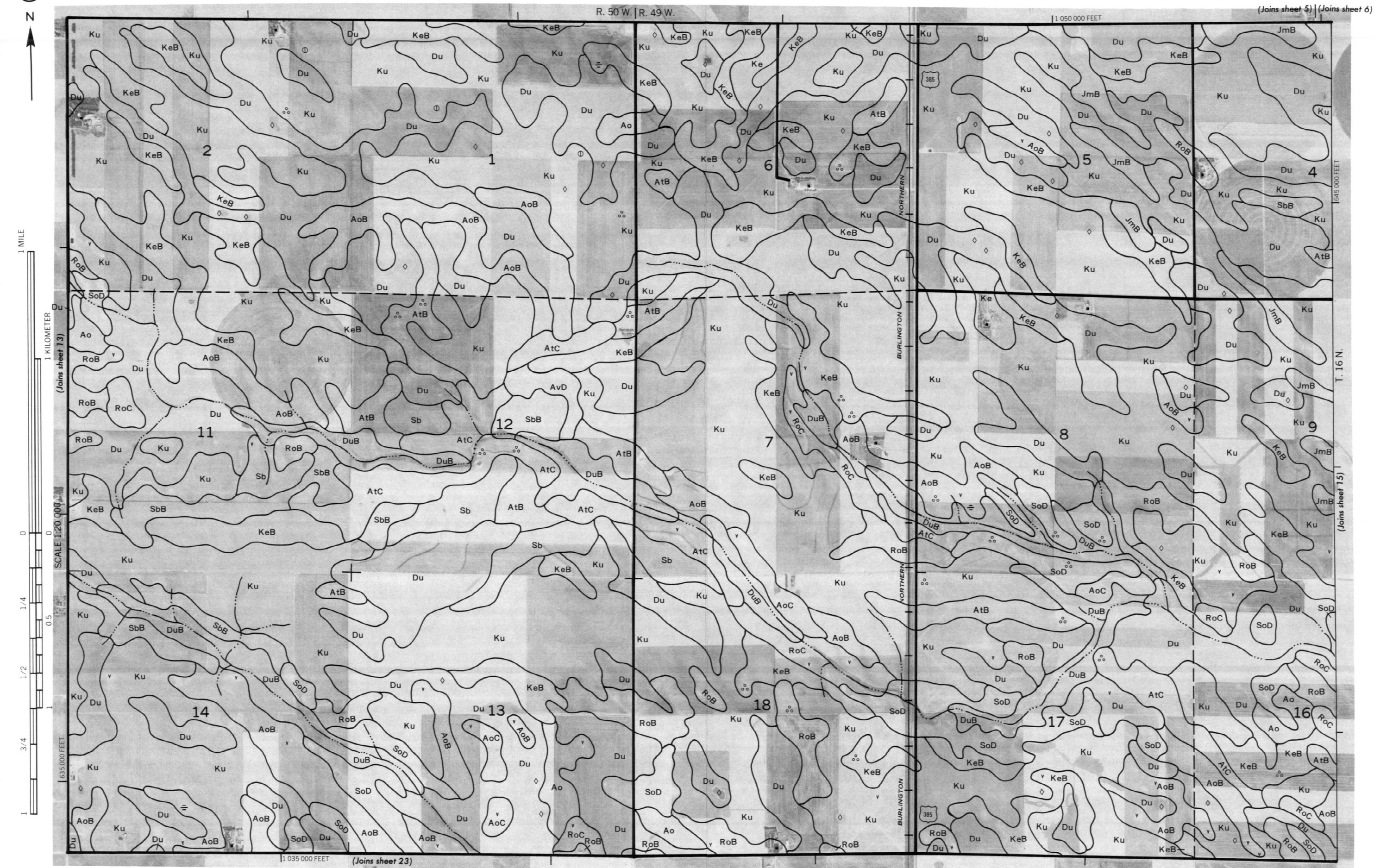
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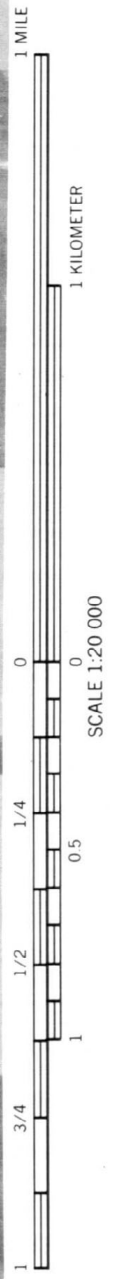
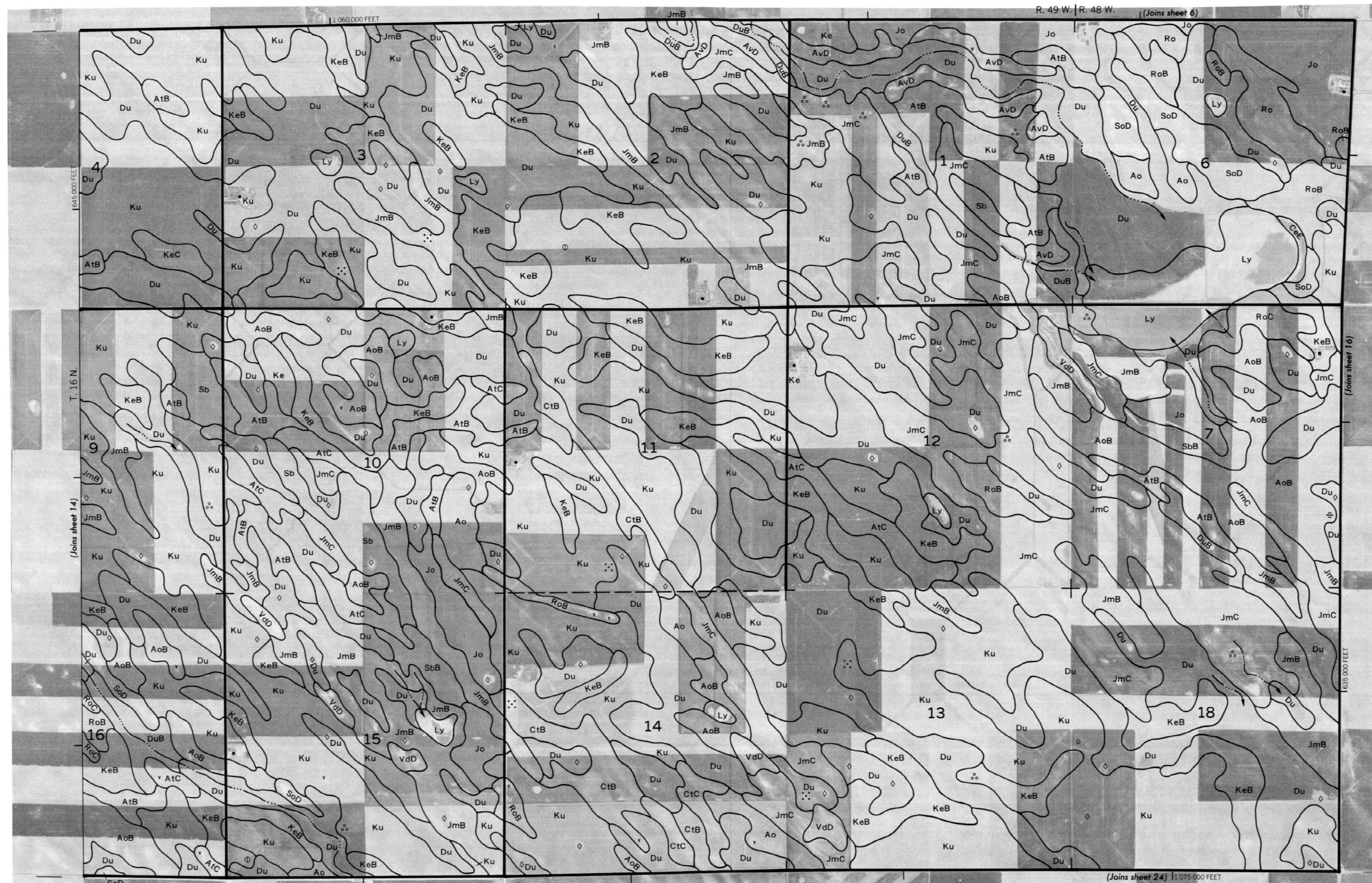
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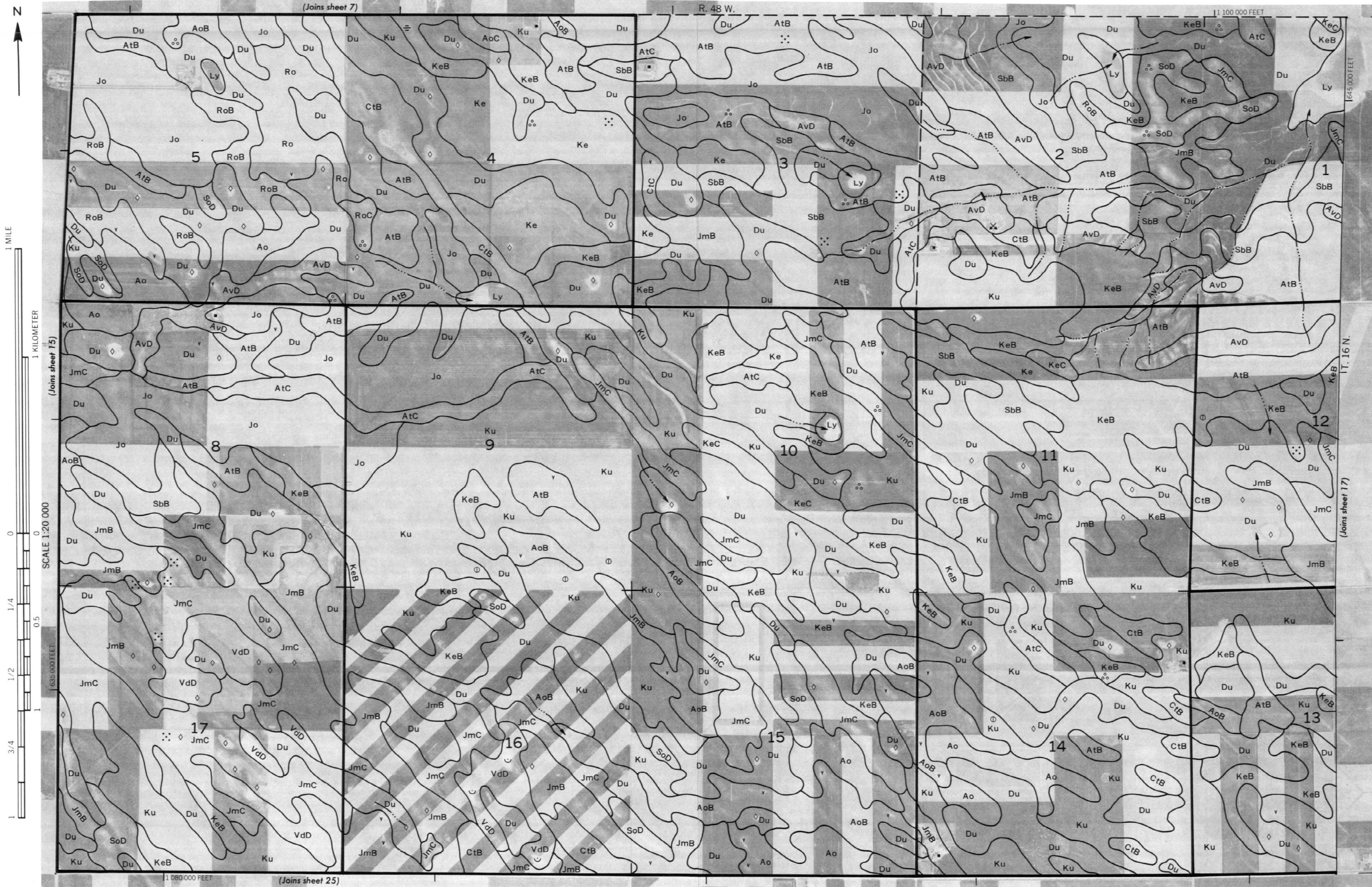




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CHEYENNE COUNTY, NEBRASKA NO. 15





CHEYENNE COUNTY, NEBRASKA NO. 16

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1110,000 FEET

N

MILE

1 KILOMETER

0
SCALE 1:20 000

1/4

0.5

1/2

1

3/4

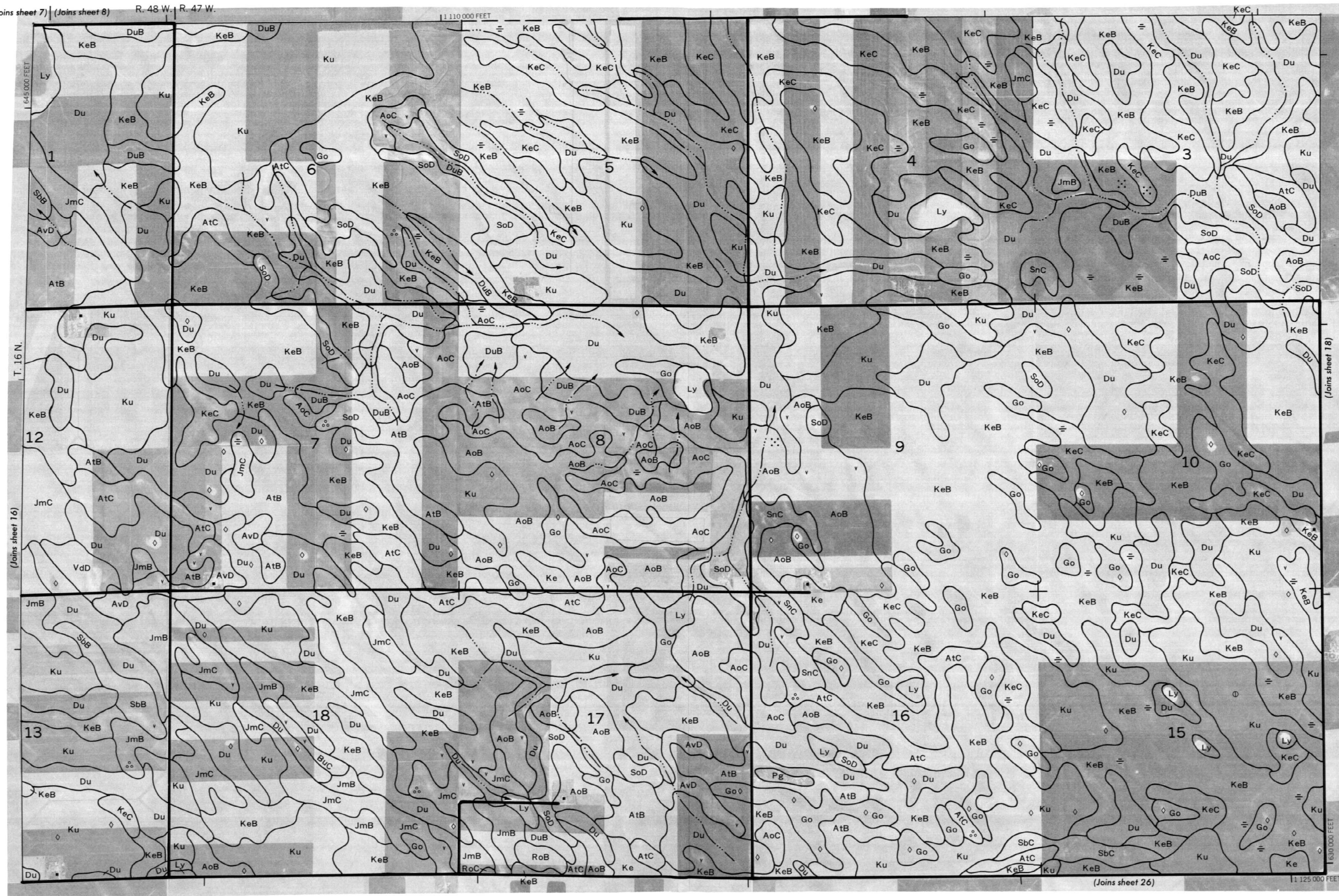
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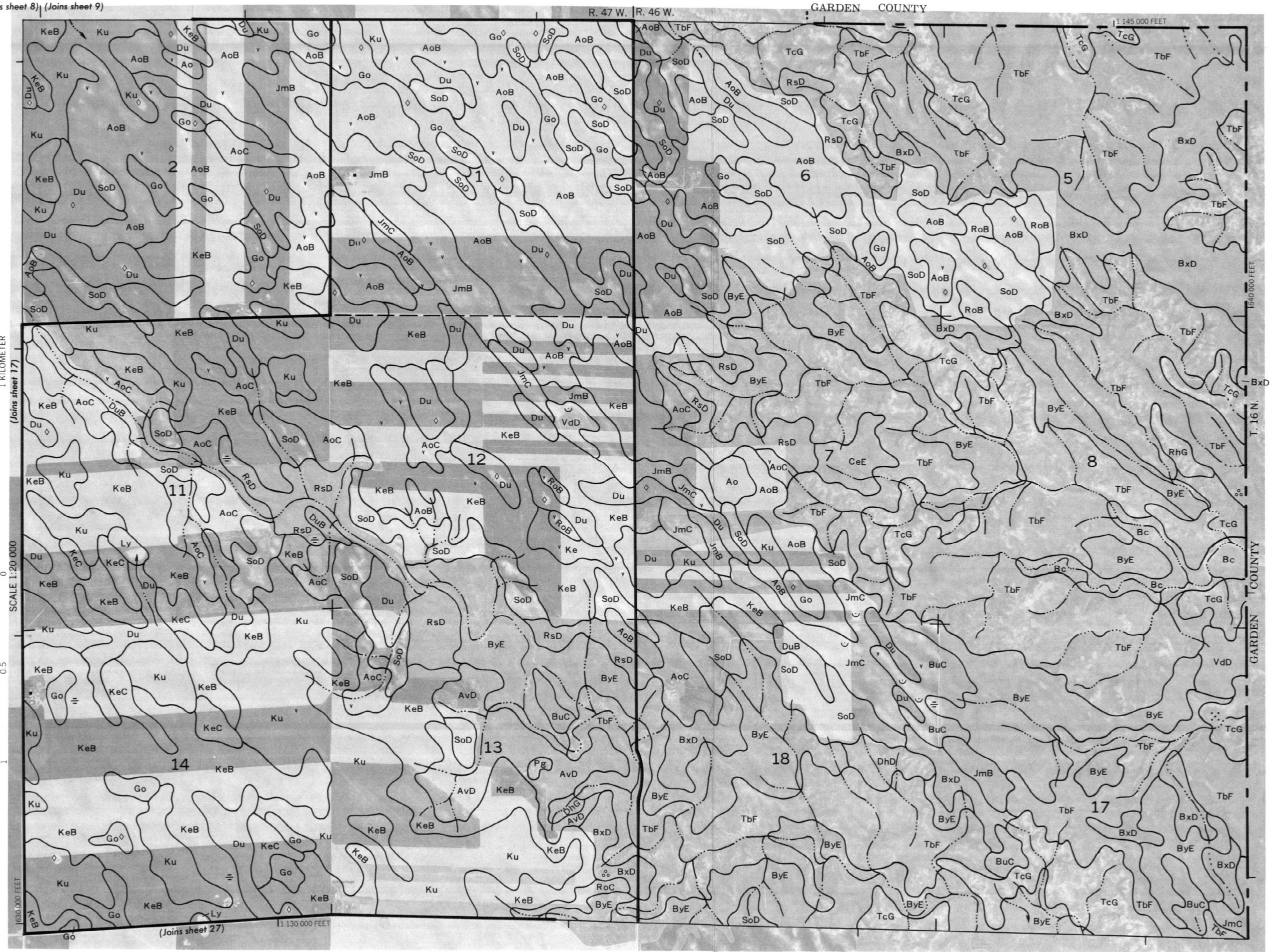
1 125 000 FEET

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CHEYENNE COUNTY, NEBRASKA NO. 17



(Joins sheet 8) (Joins sheet 9)

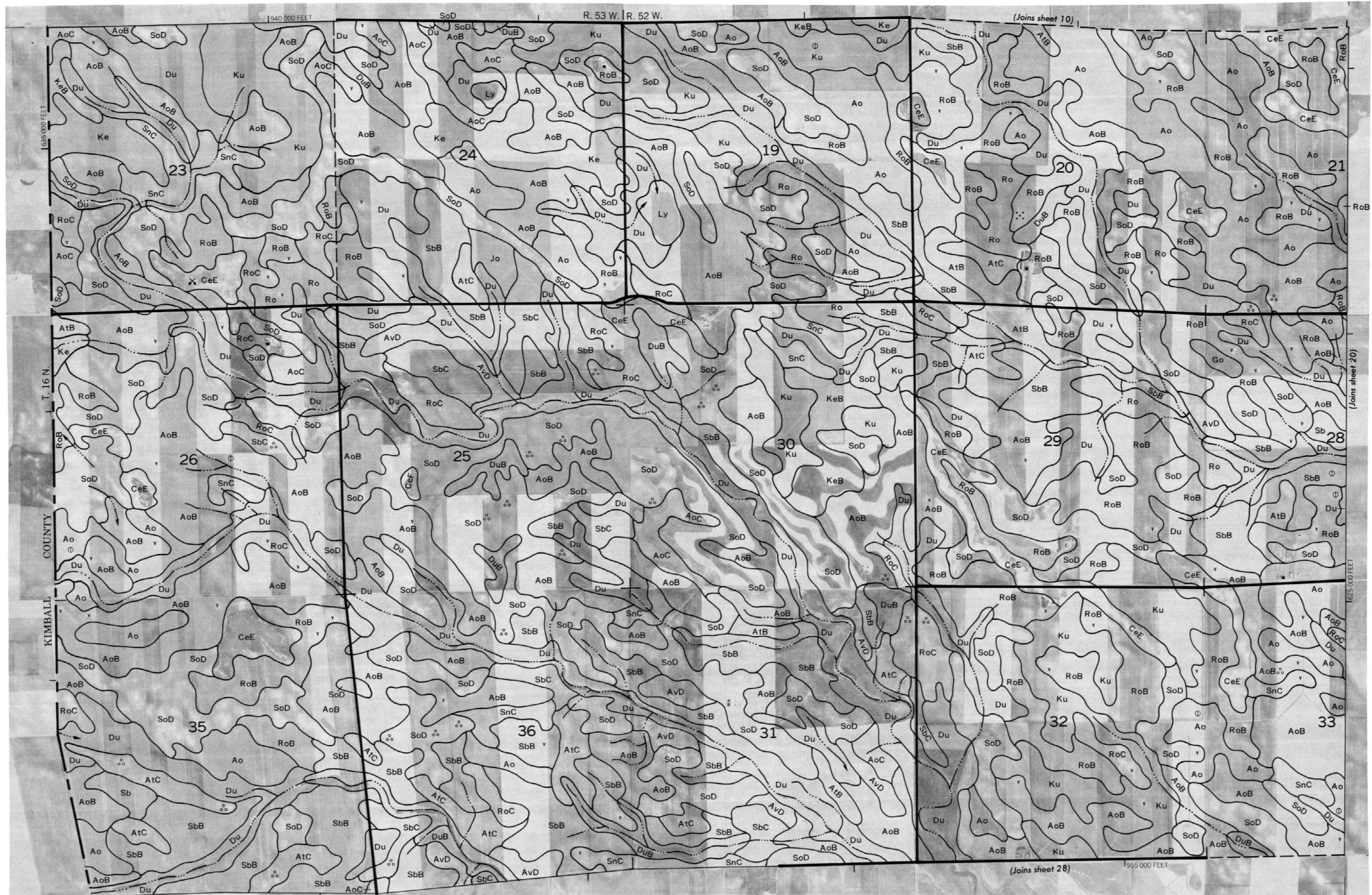


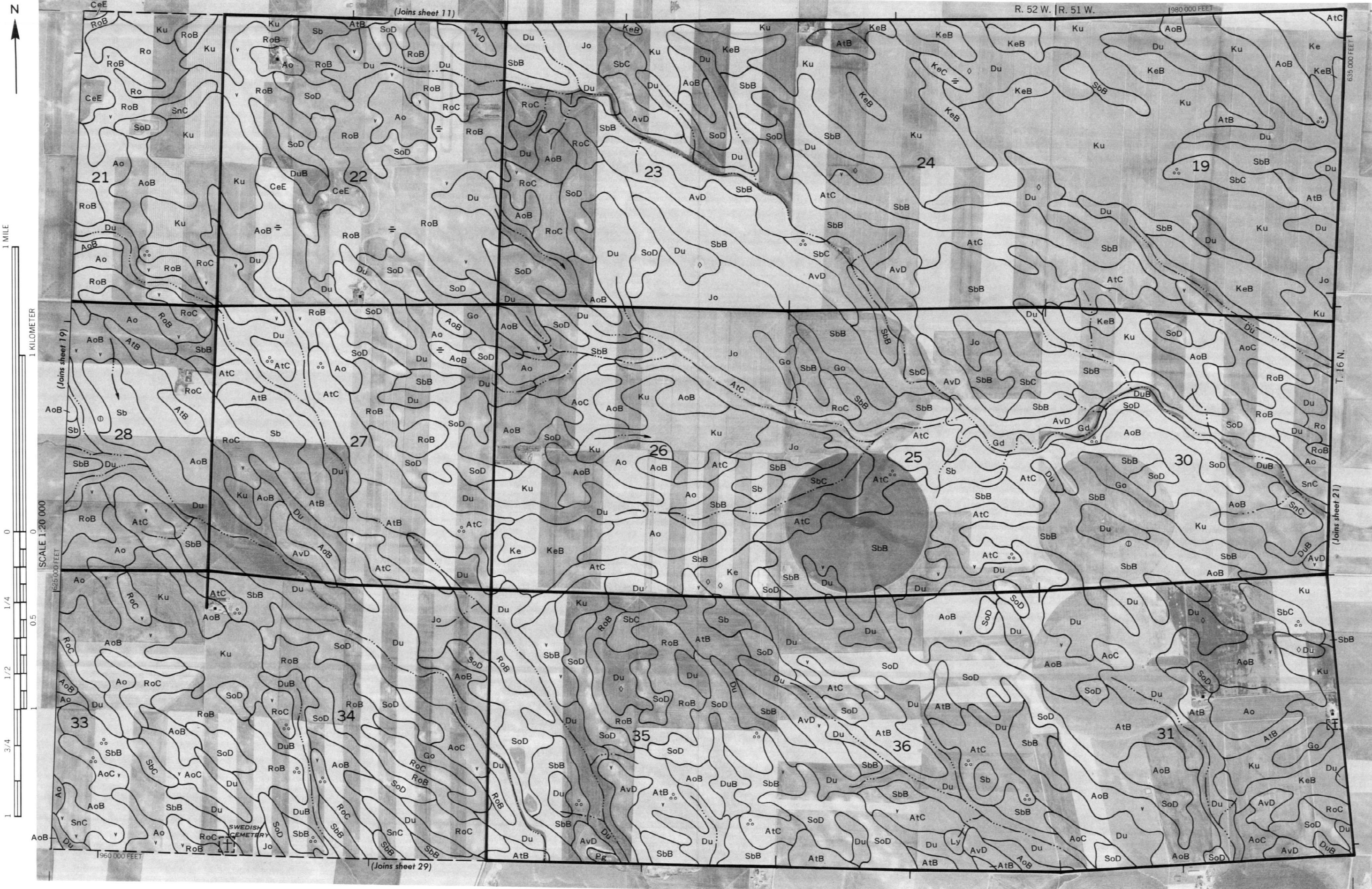
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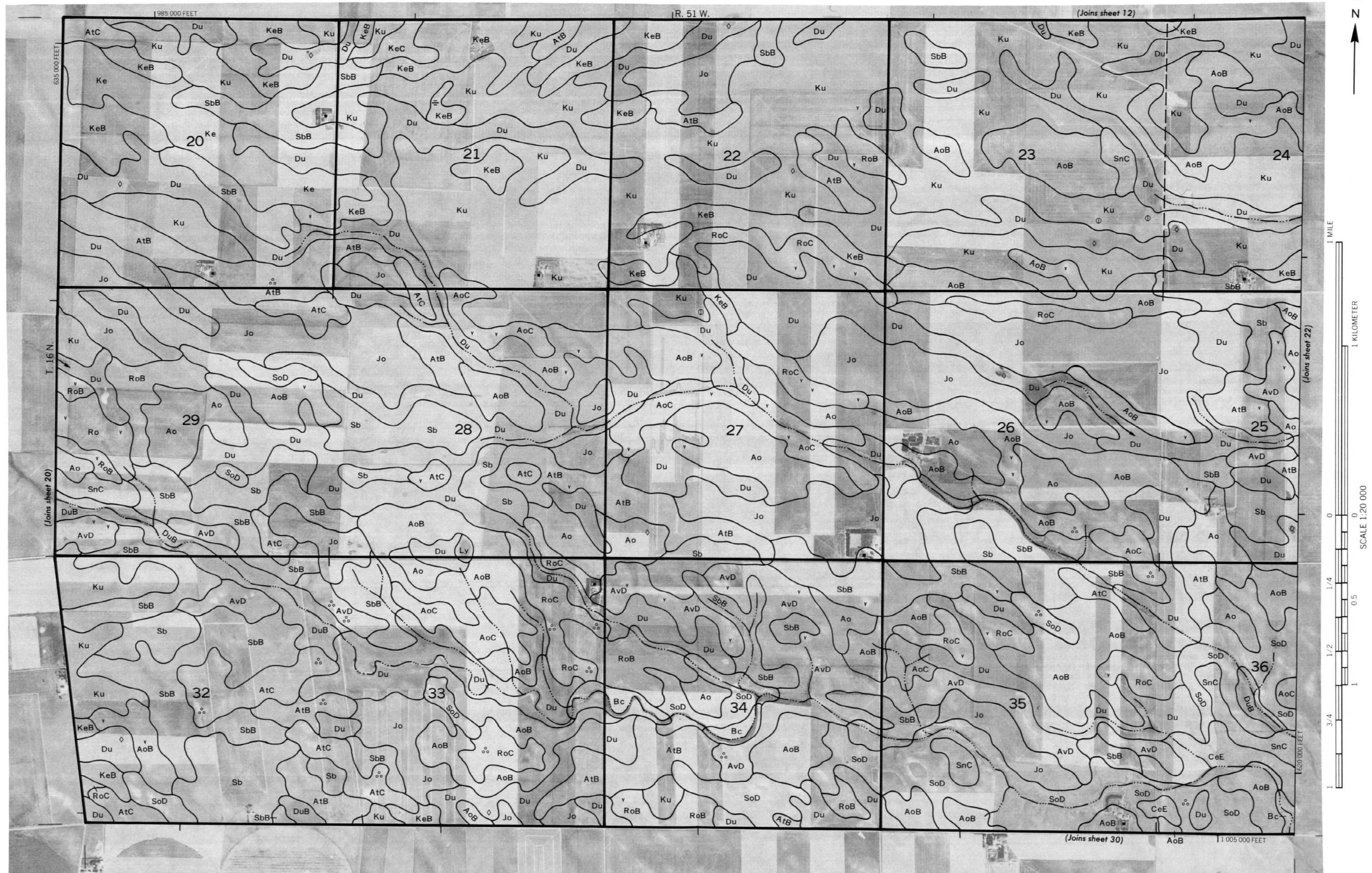
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CHEYENNE COUNTY, NEBRASKA NO. 19





CHEYENNE COUNTY, NEBRASKA NO. 21



1 MILE

1 KILOMETER

SCALE 1:20 000

1/4

1/2

3/4

1

1 1/2

2

3

4

5

N

R. 51 W. R. 50 W.

(Joins sheet 13)

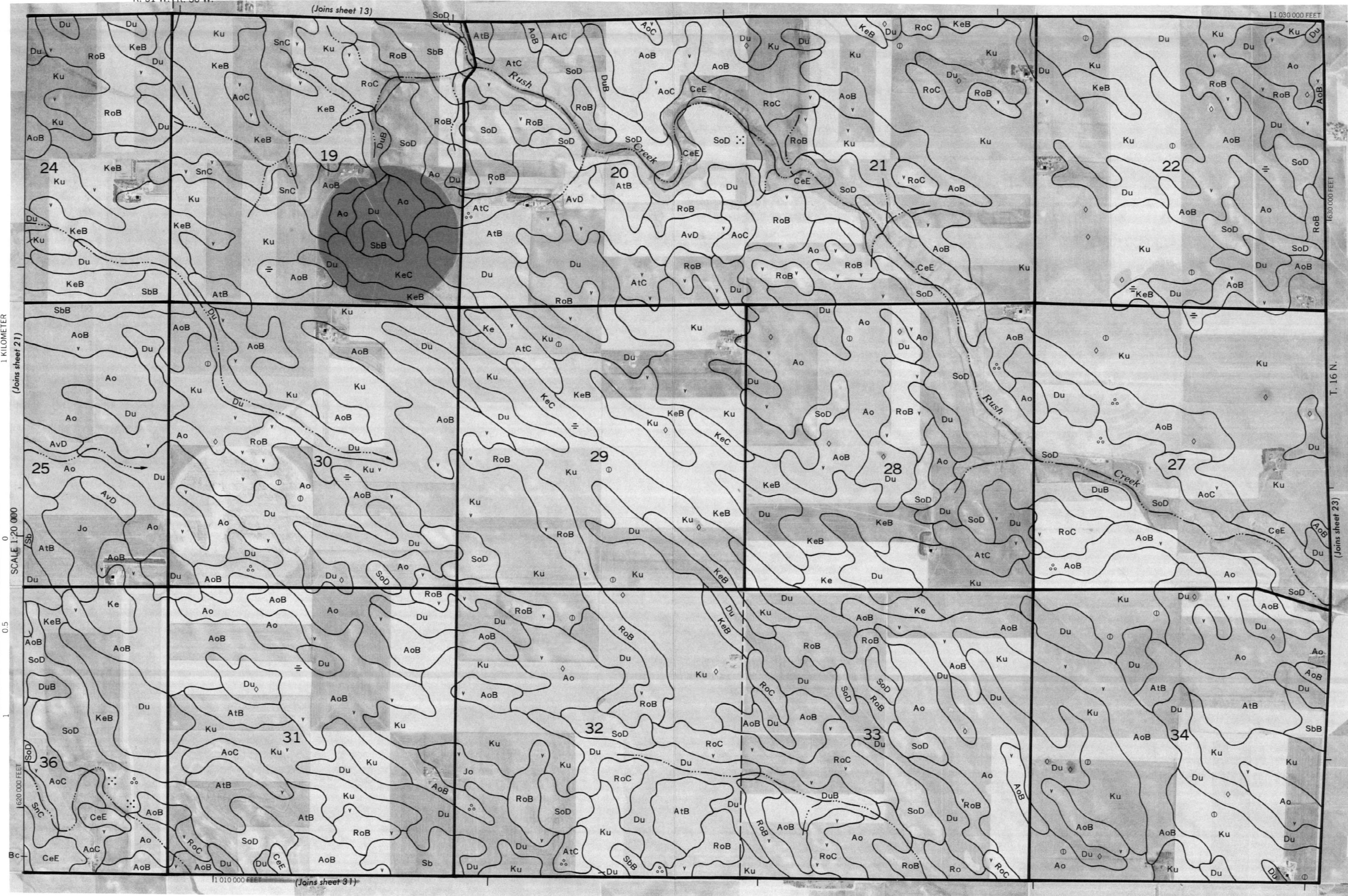
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1630 000 FEET

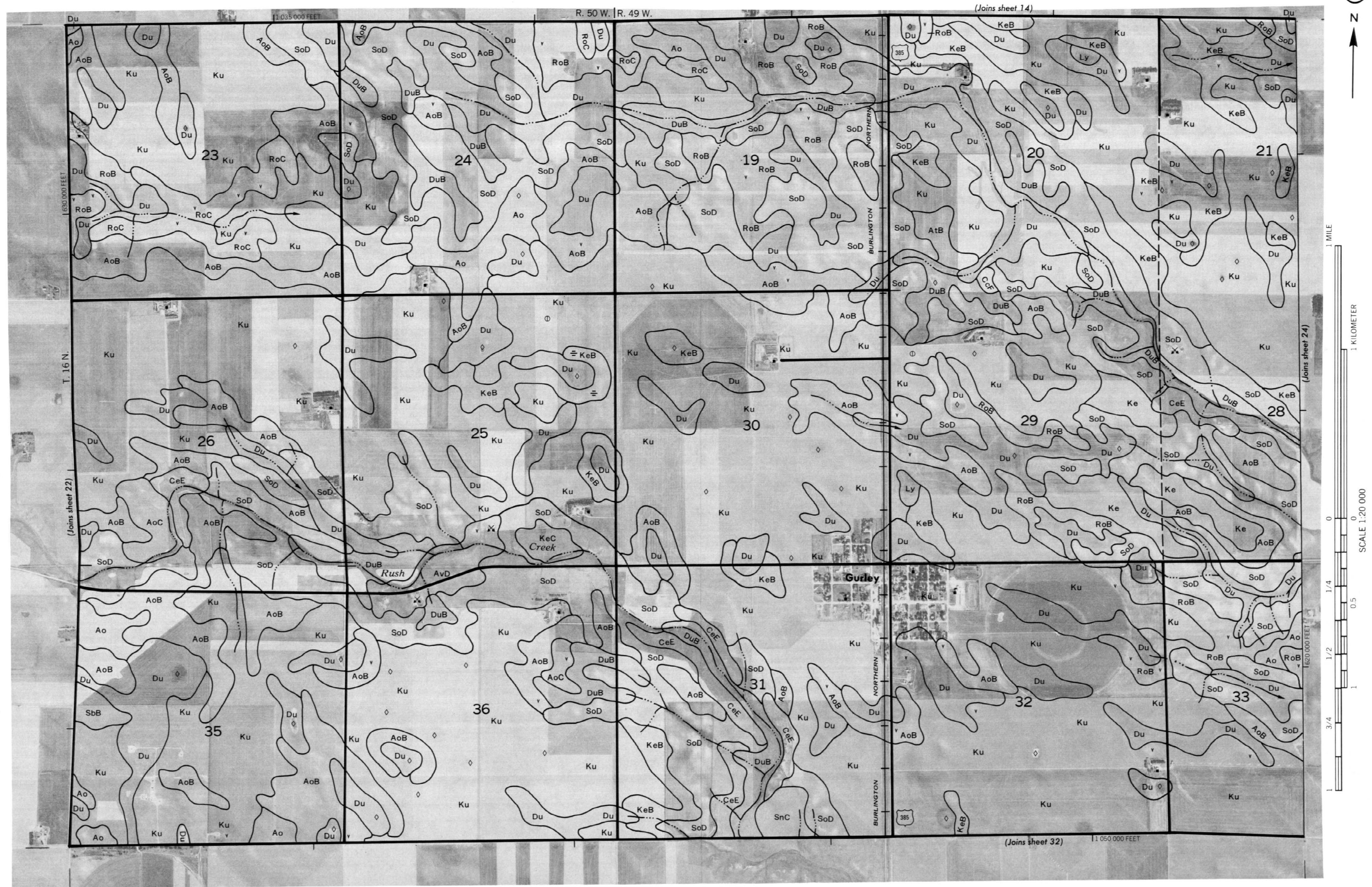
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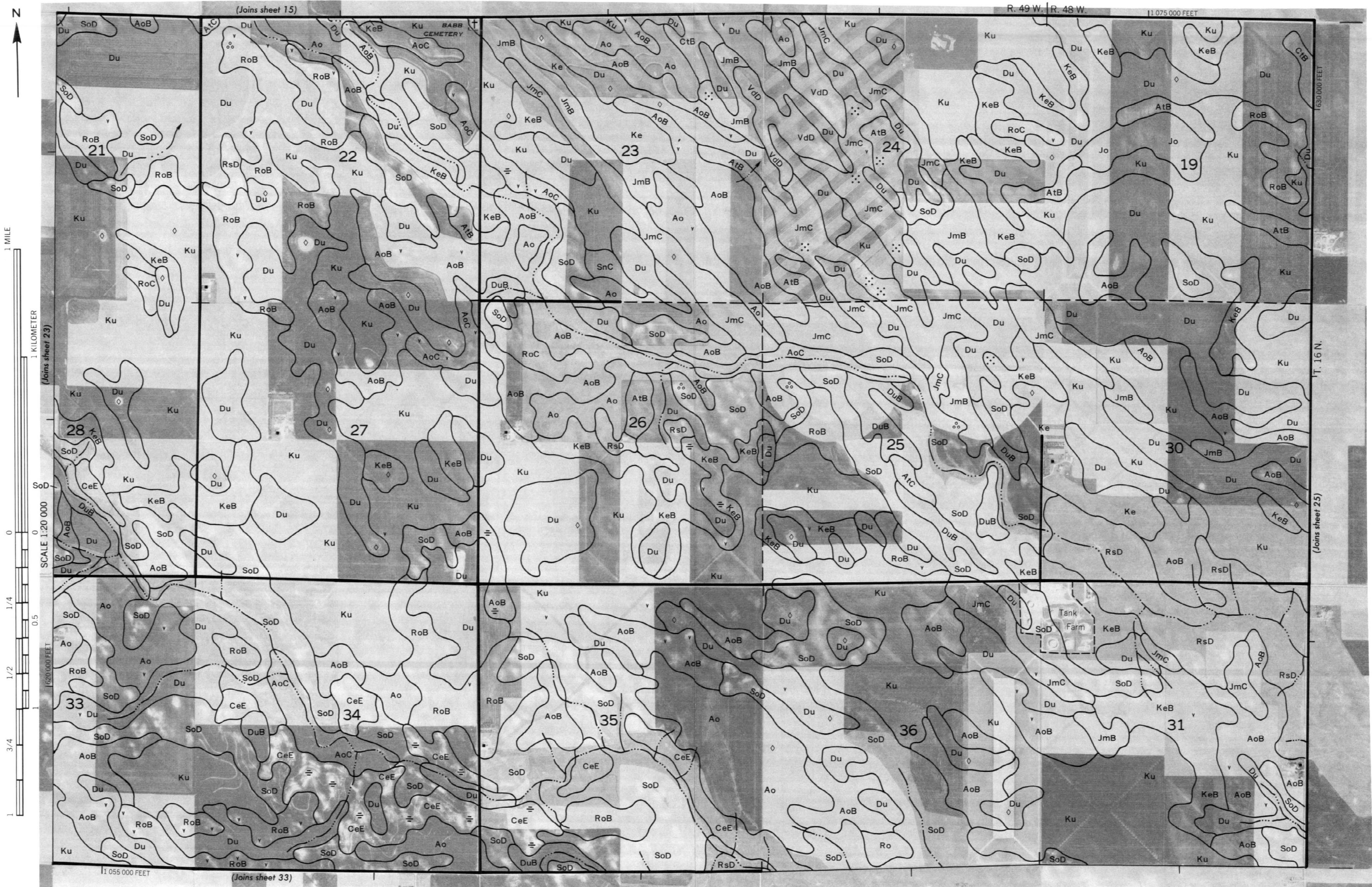
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CHEYENNE COUNTY, NEBRASKA NO. 23



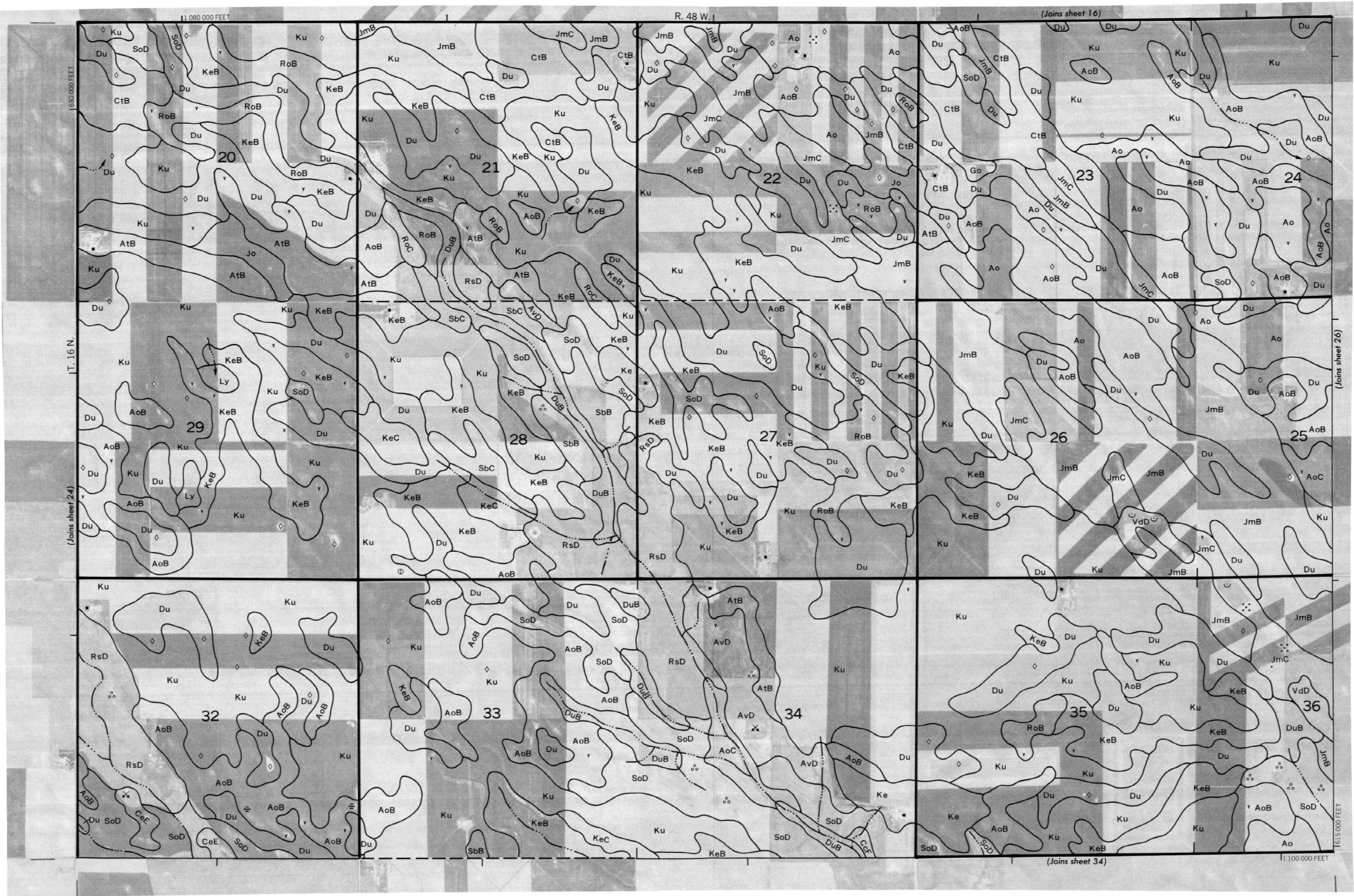


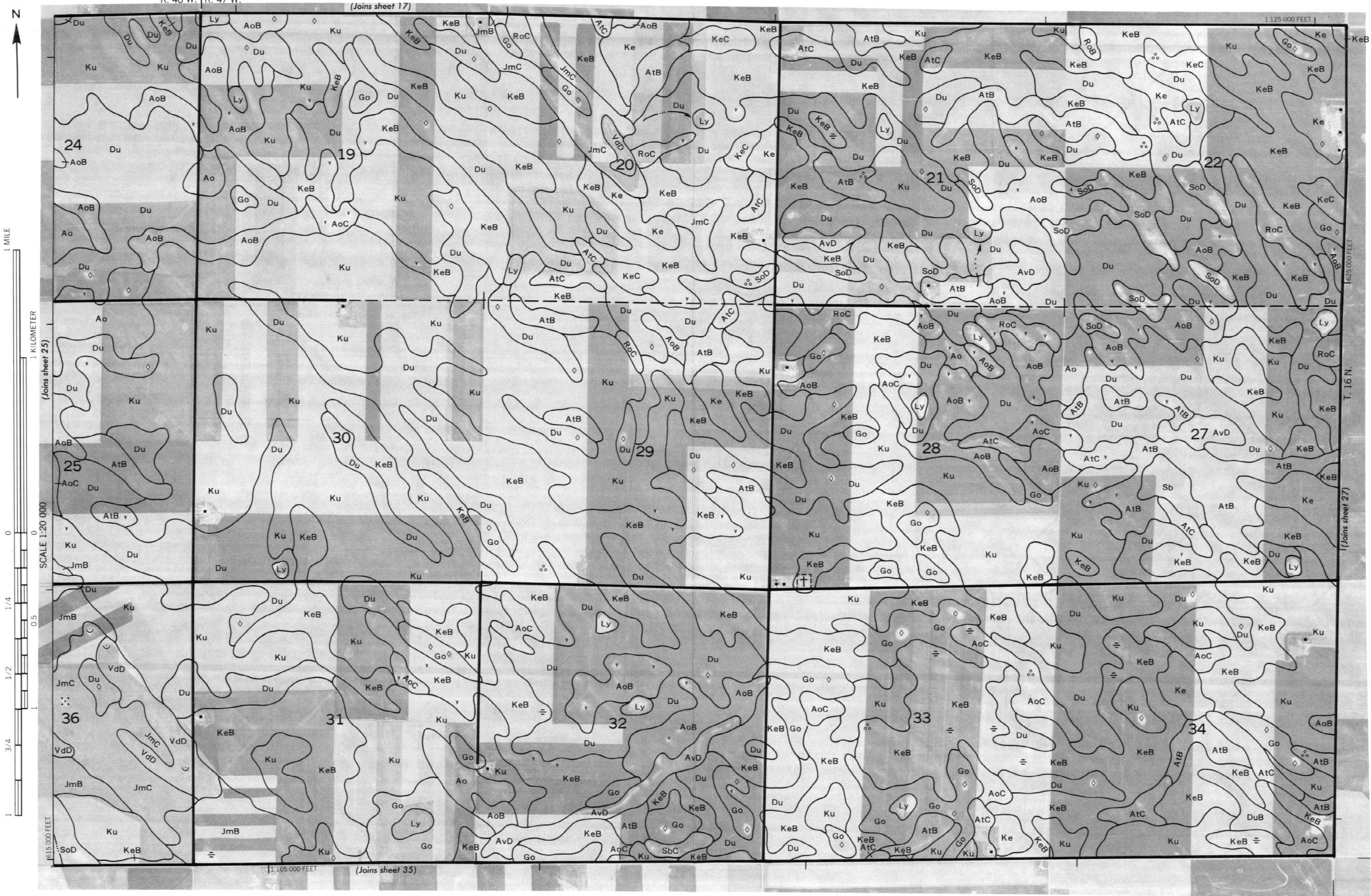
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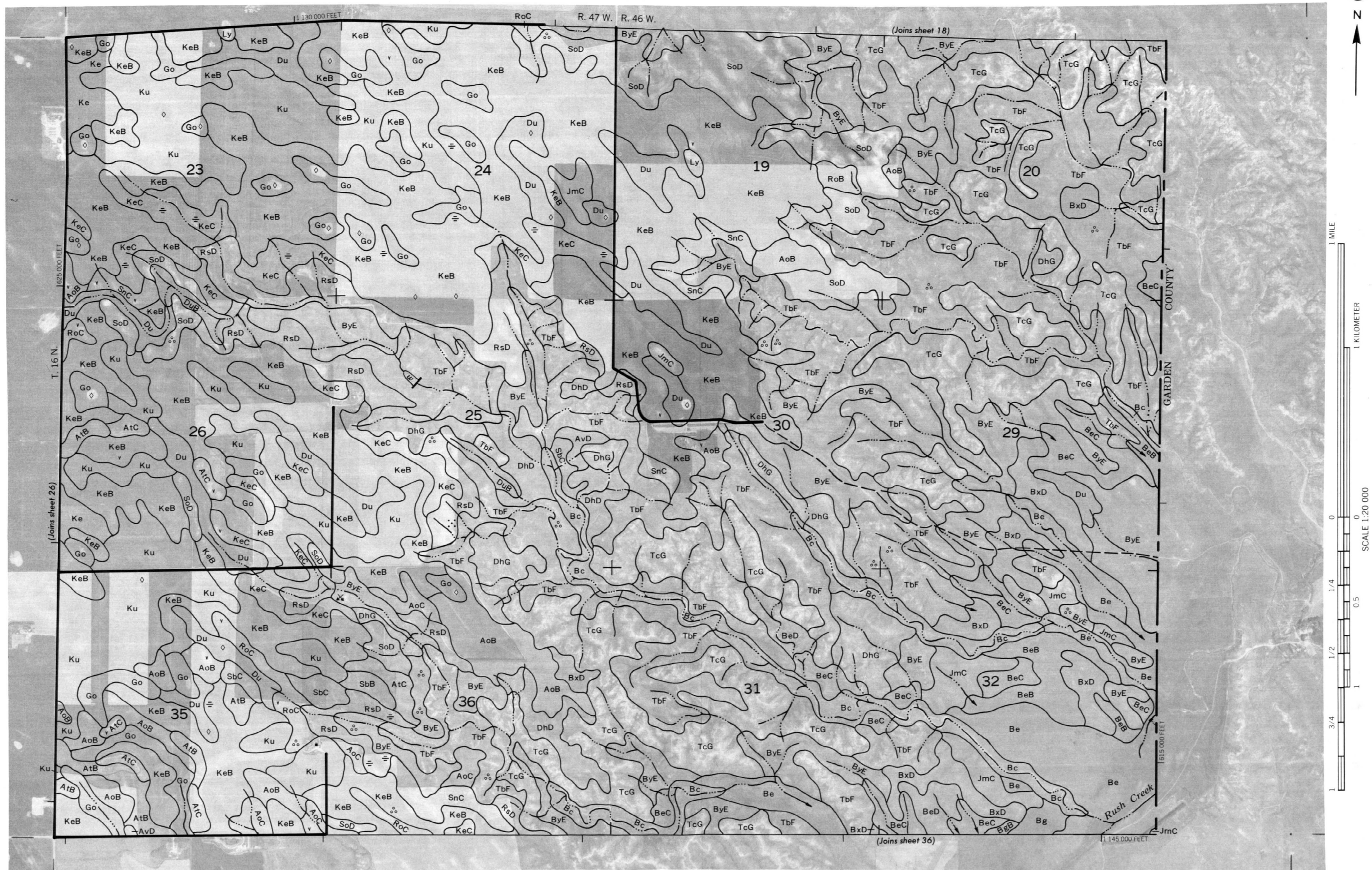
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 25





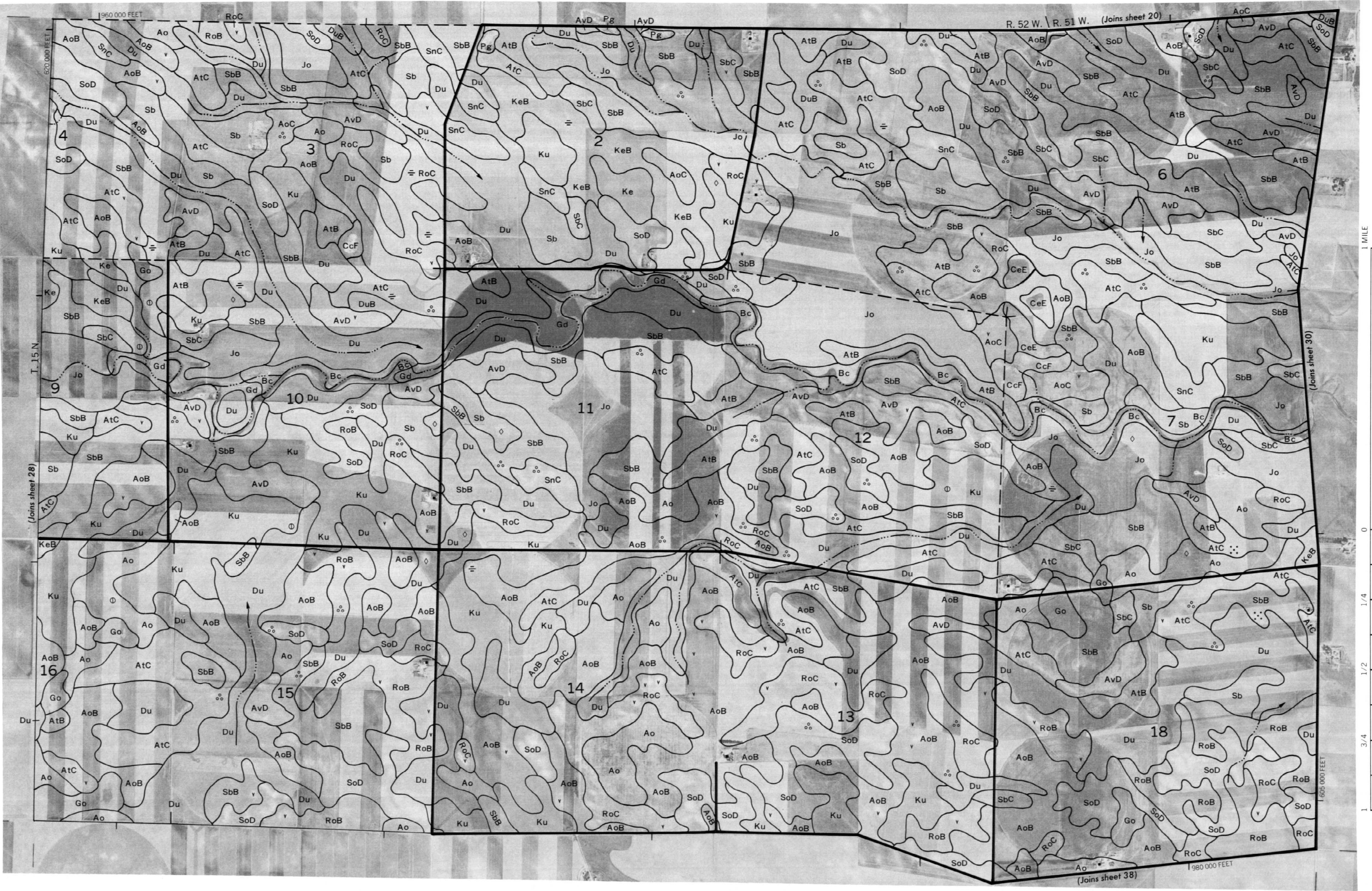
CHEYENNE COUNTY, NEBRASKA NO. 27





CHEYENNE COUNTY, NEBRASKA NO. 29

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SCALE 1:20 000



1 MILE

1 KILOMETER

SCALE 1:20 000

0

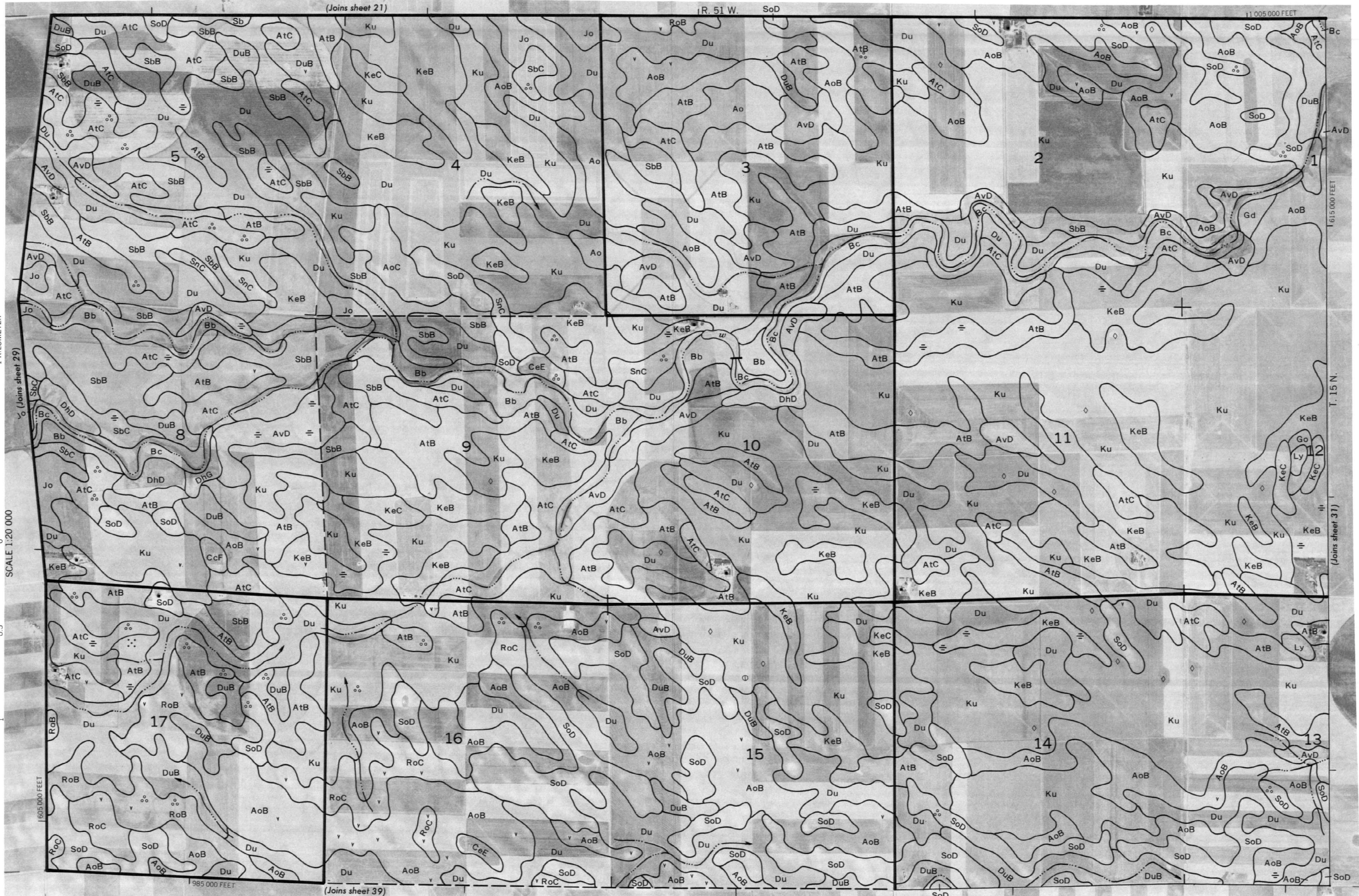
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1/4

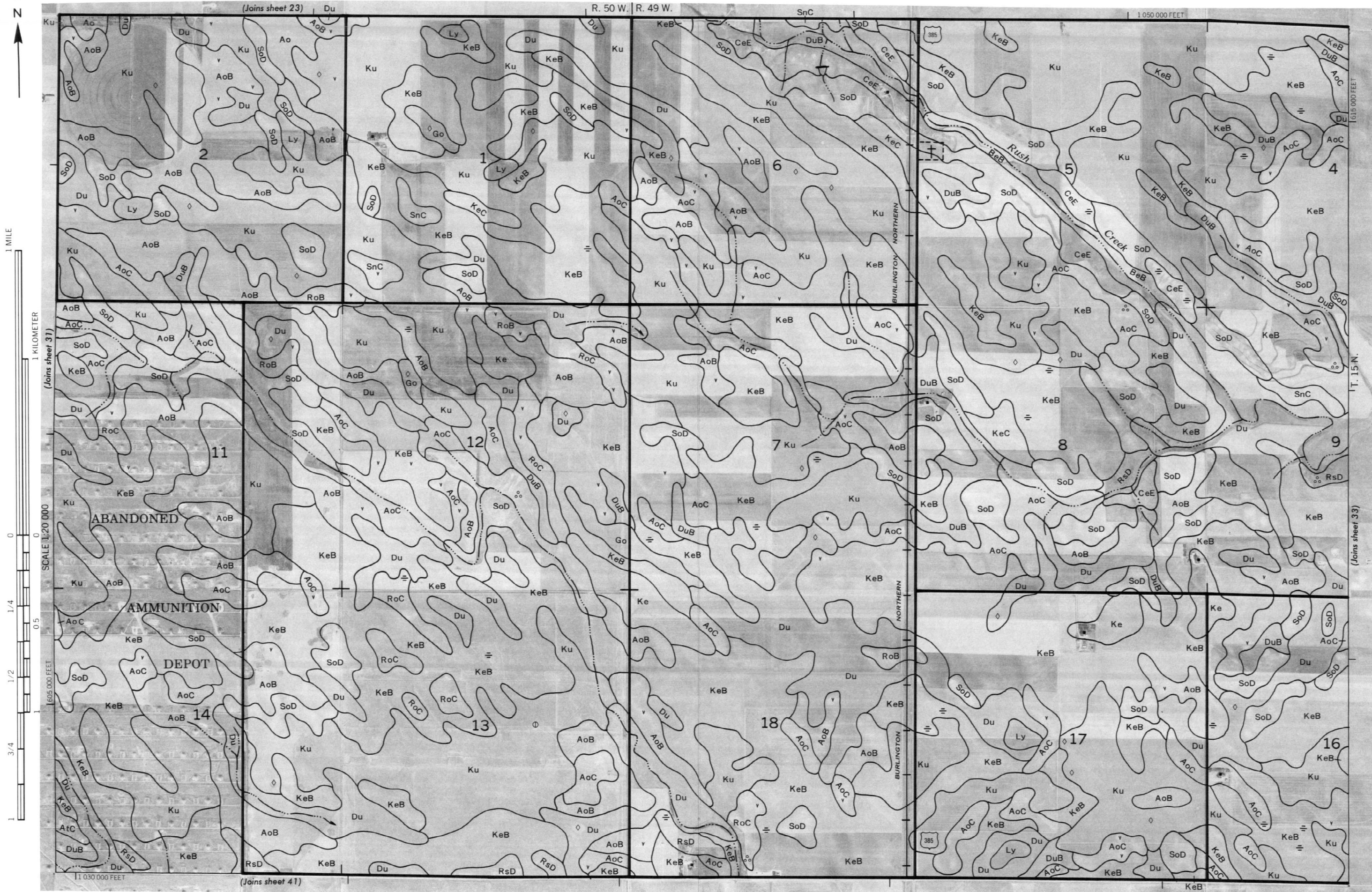
1/2

3/4

1

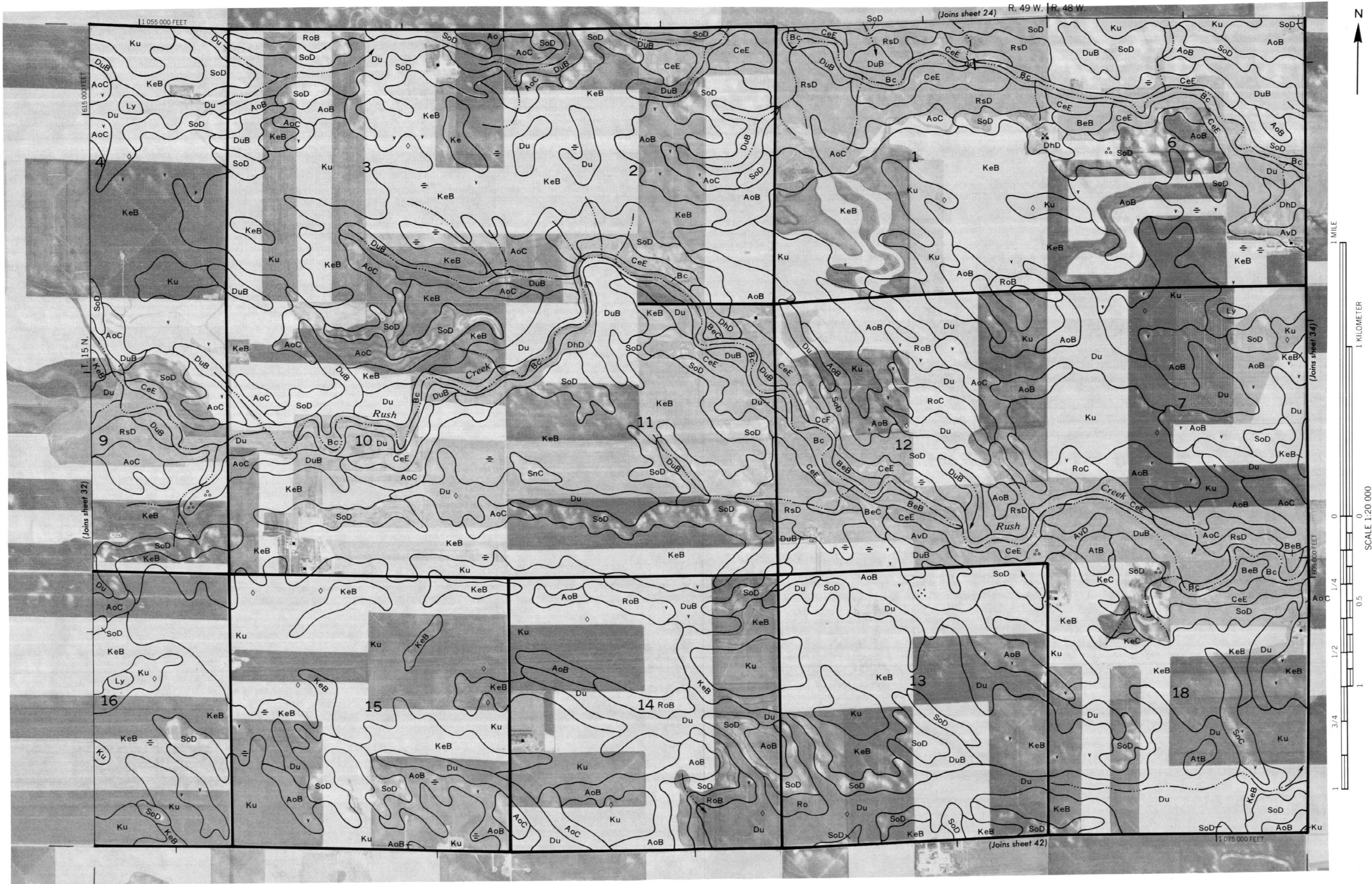






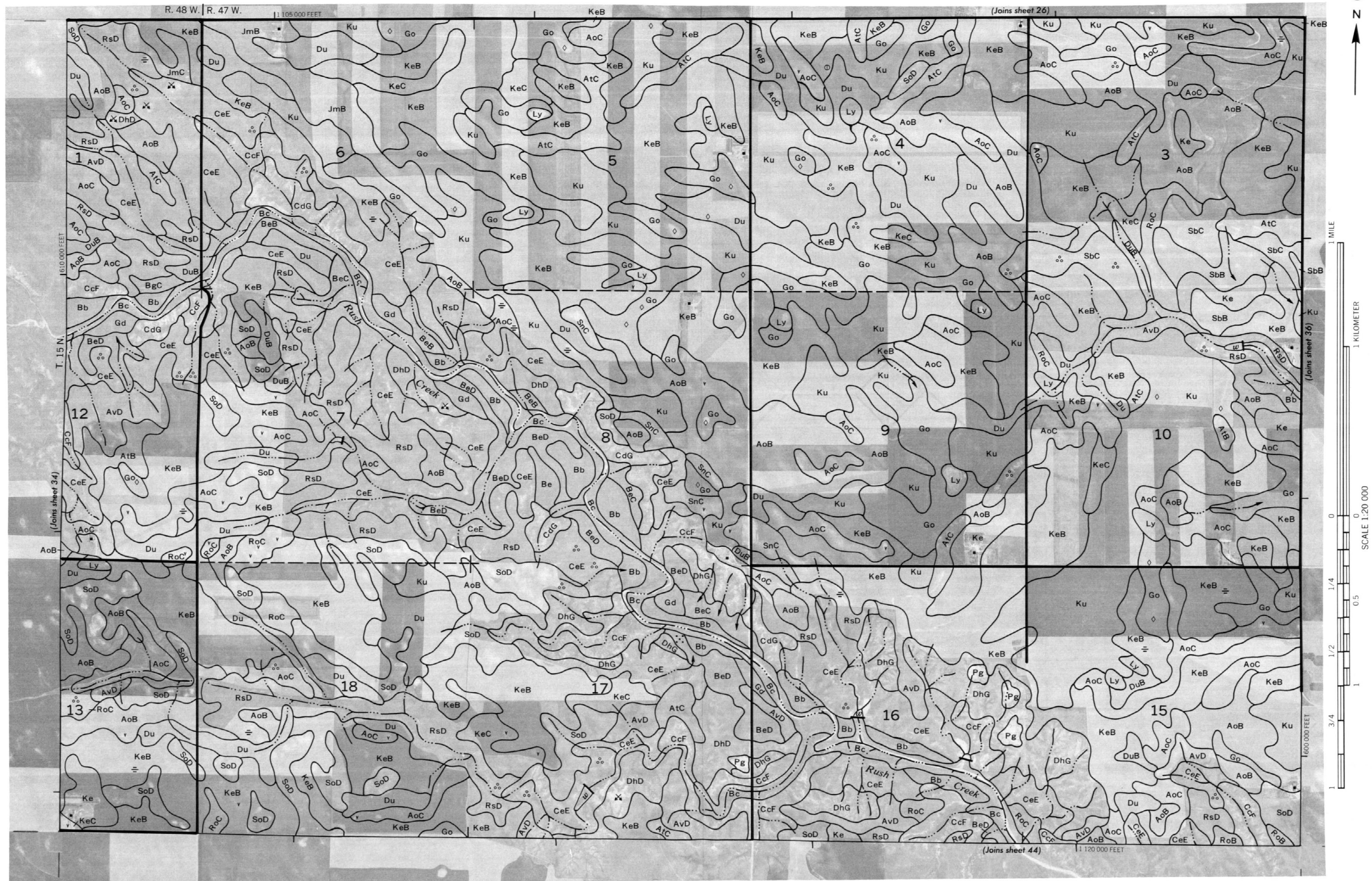
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

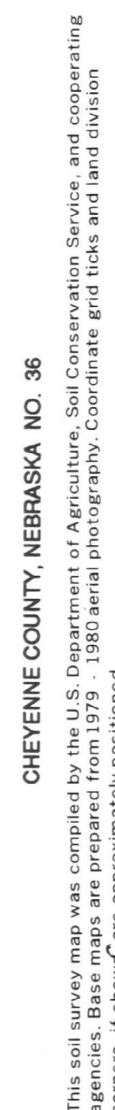
CHEYENNE COUNTY, NEBRASKA NO. 33

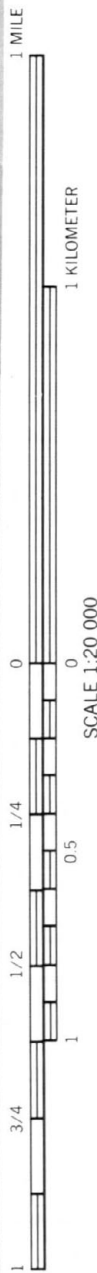




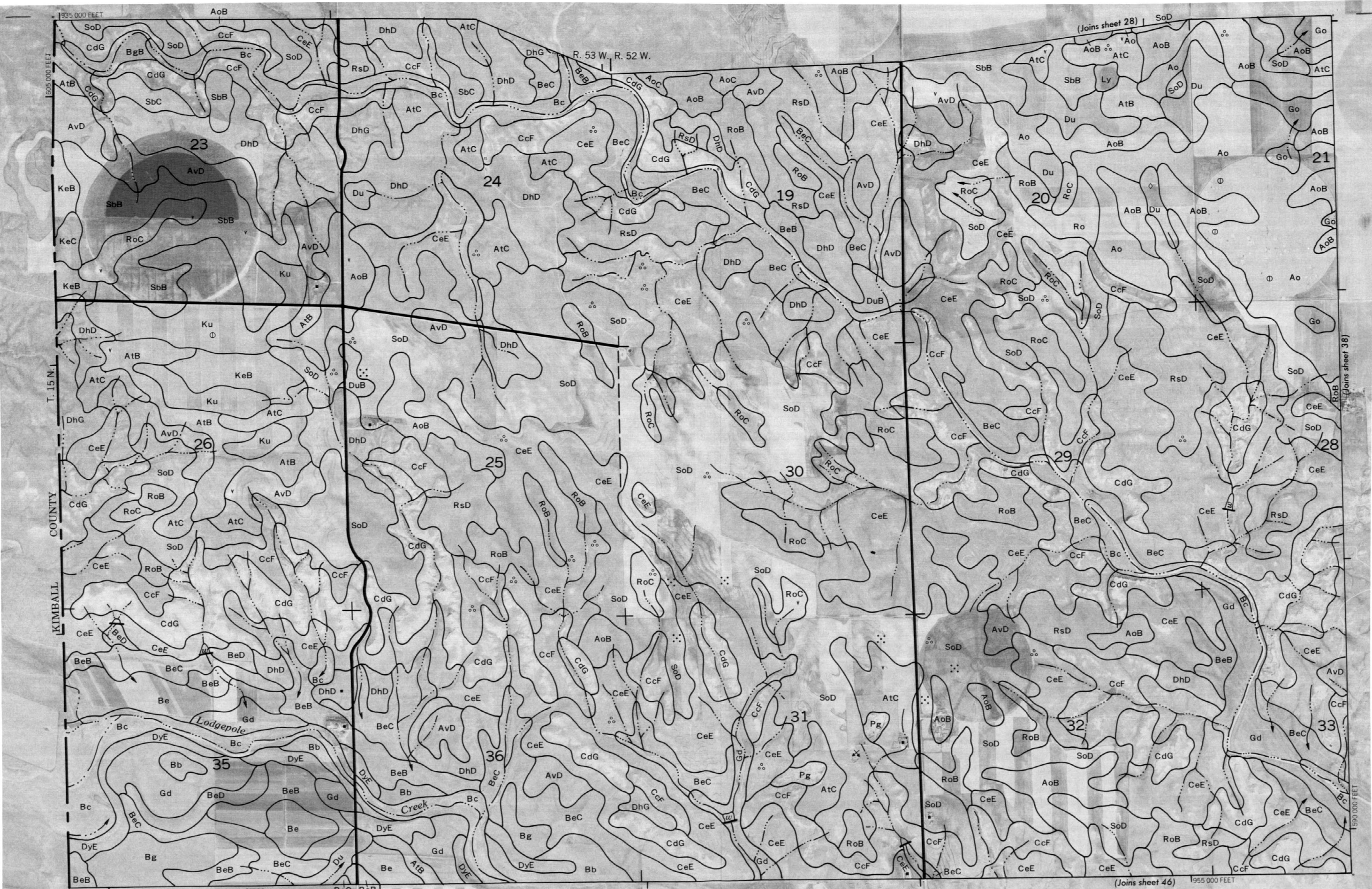
CHEYENNE COUNTY, NEBRASKA NO. 35



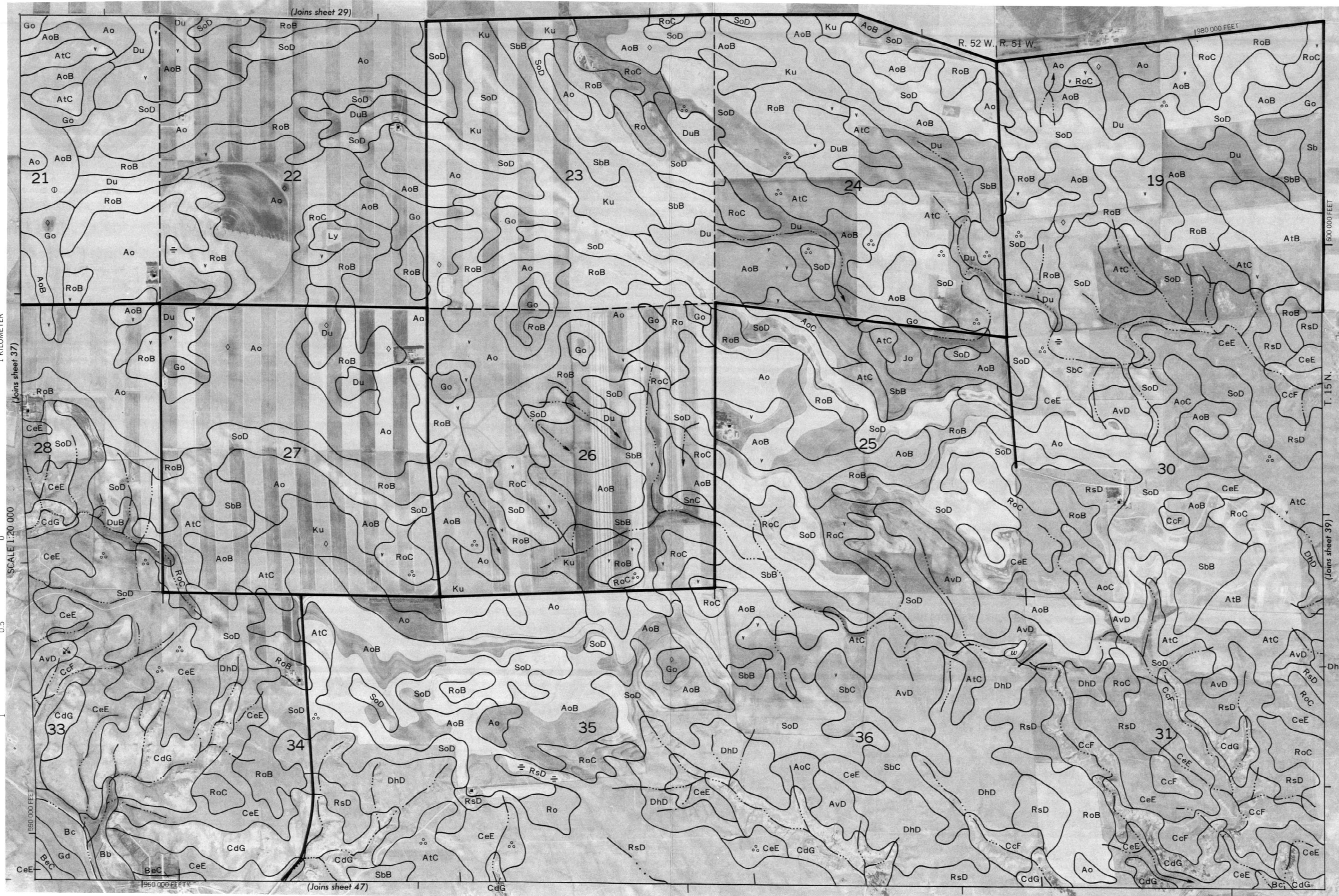




CHEYENNE COUNTY, NEBRASKA NO. 37

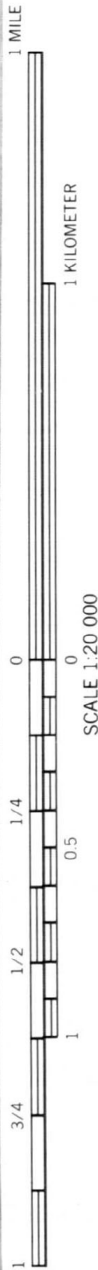
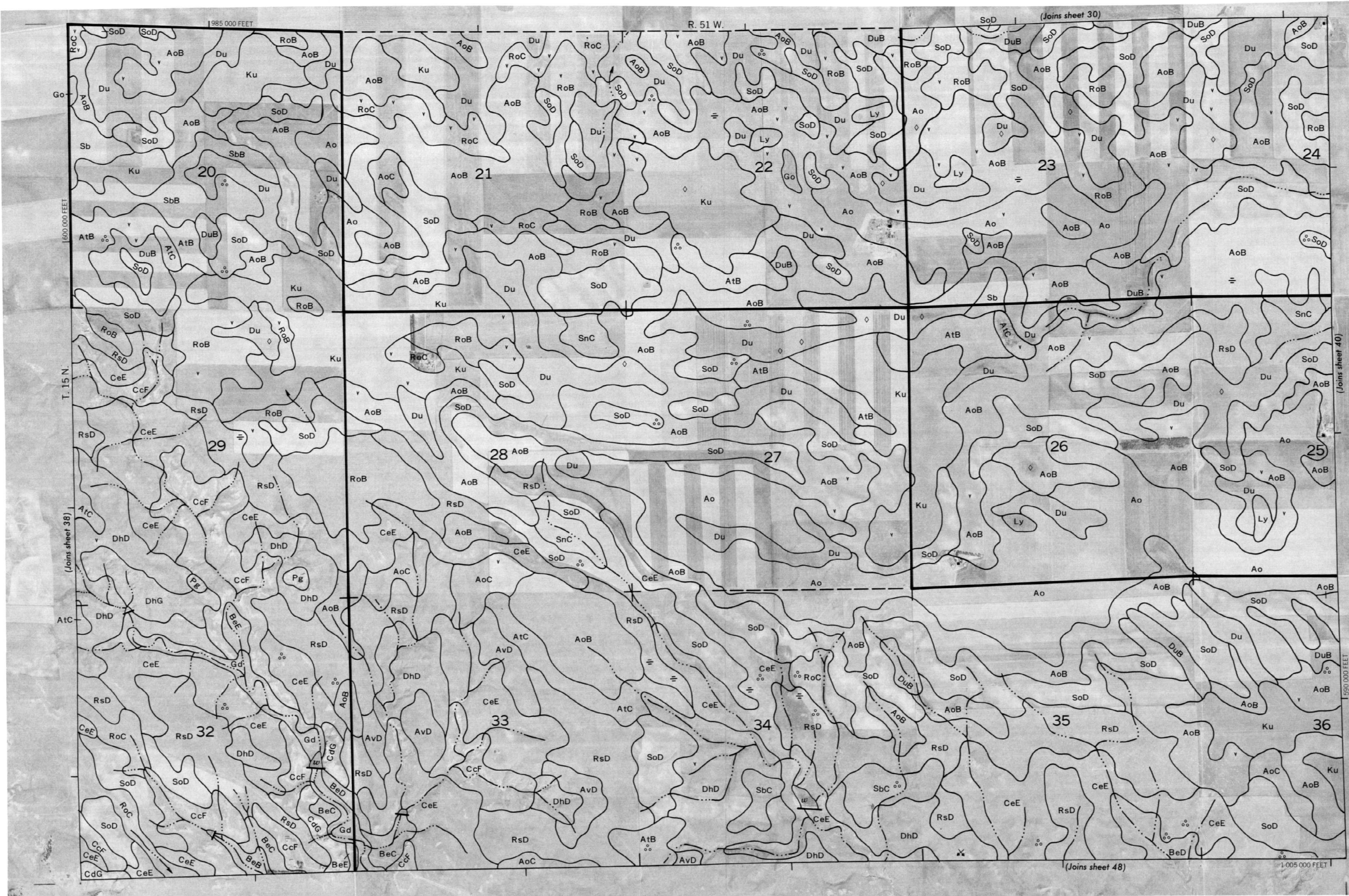


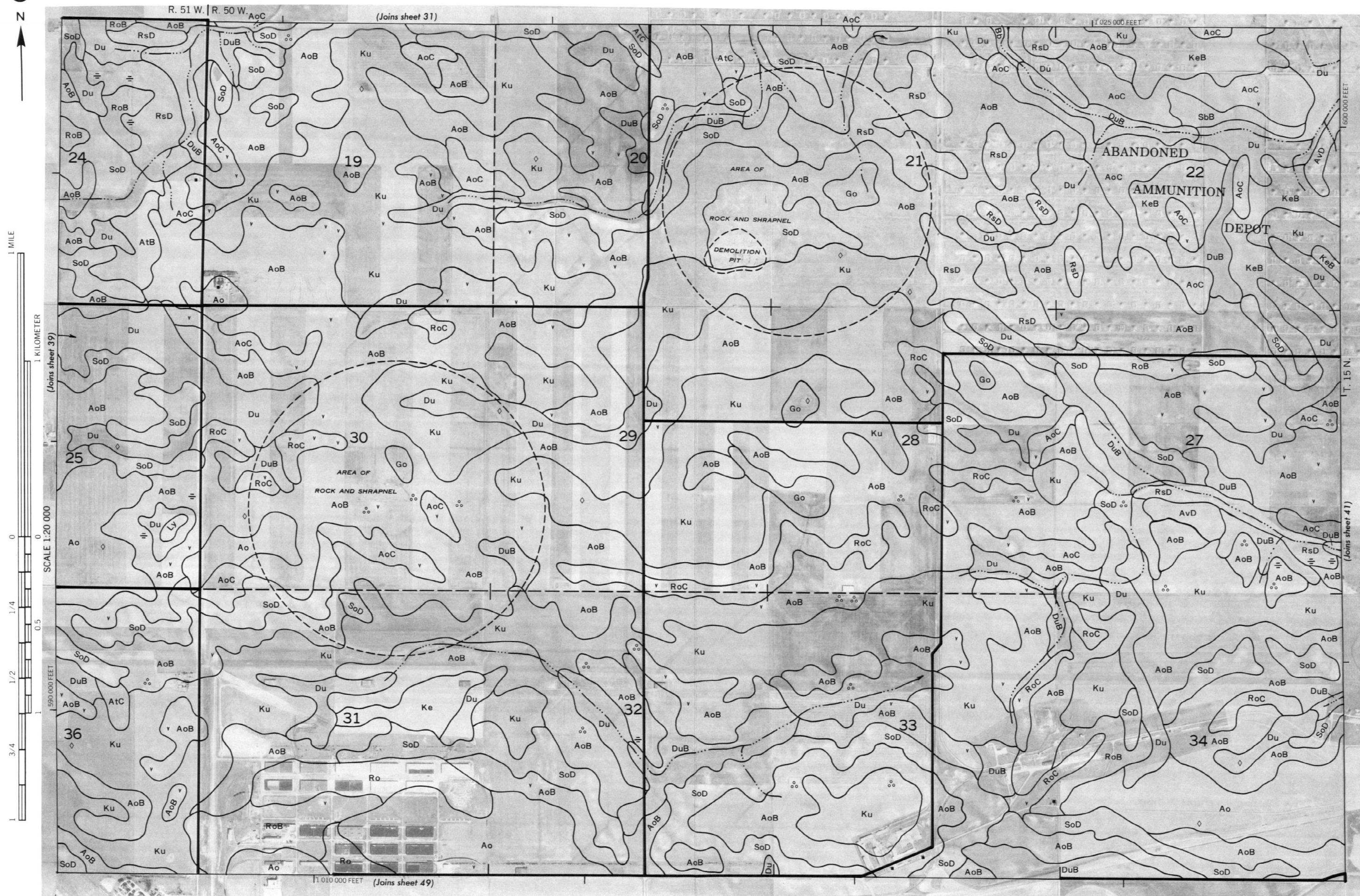
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CHEYENNE COUNTY, NEBRASKA NO. 39

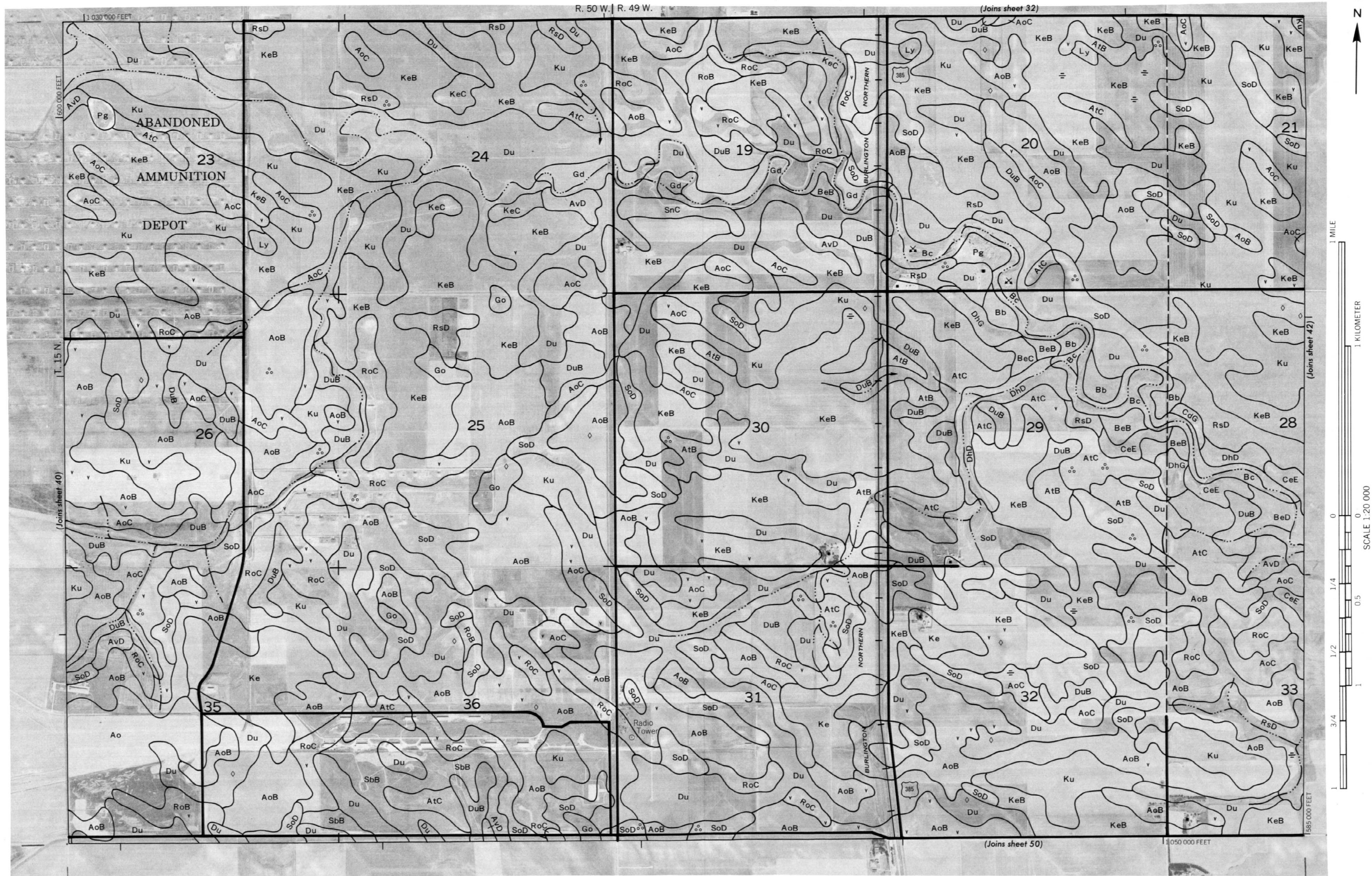
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

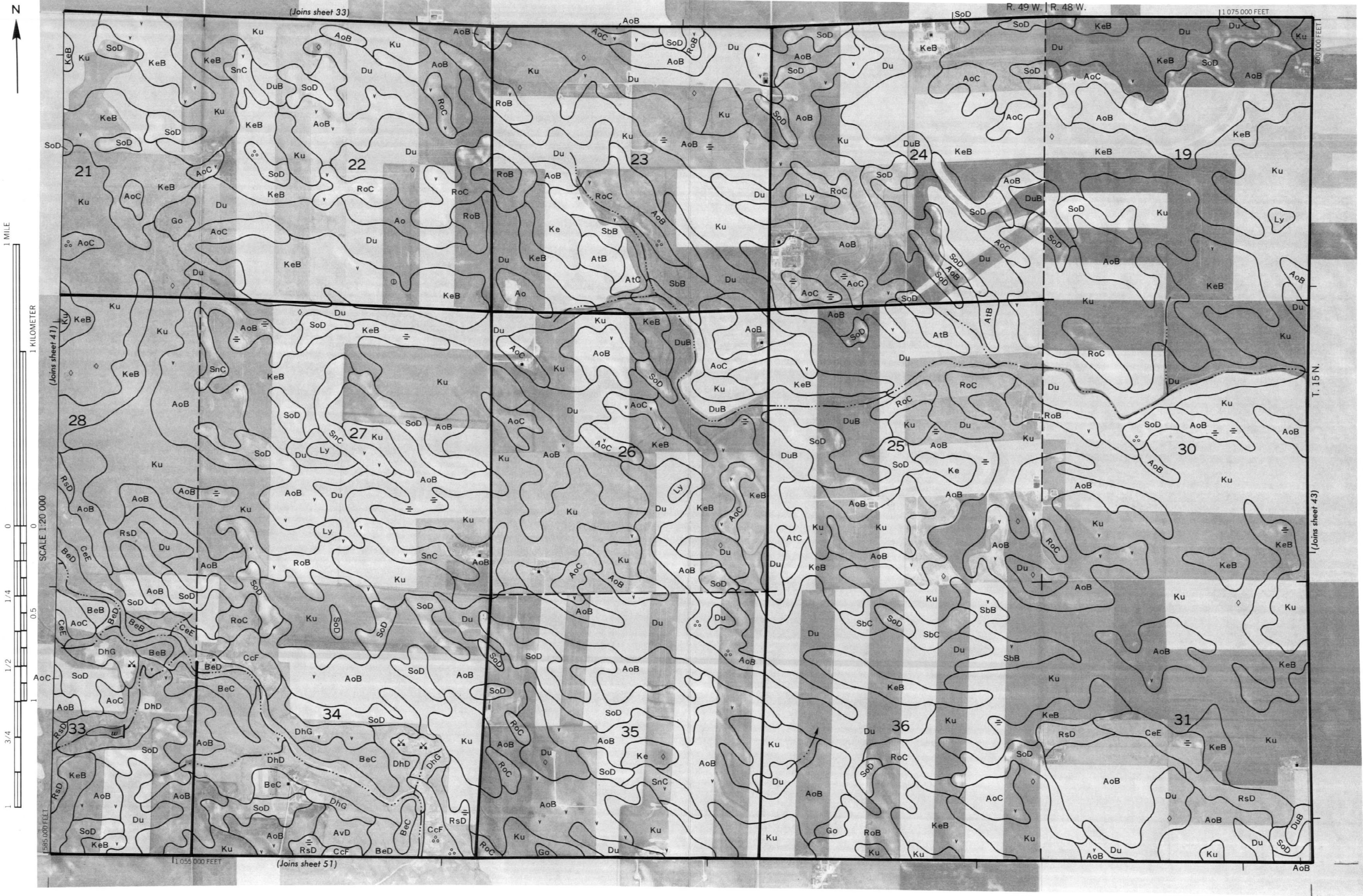




CHEYENNE COUNTY, NEBRASKA NO. 41

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



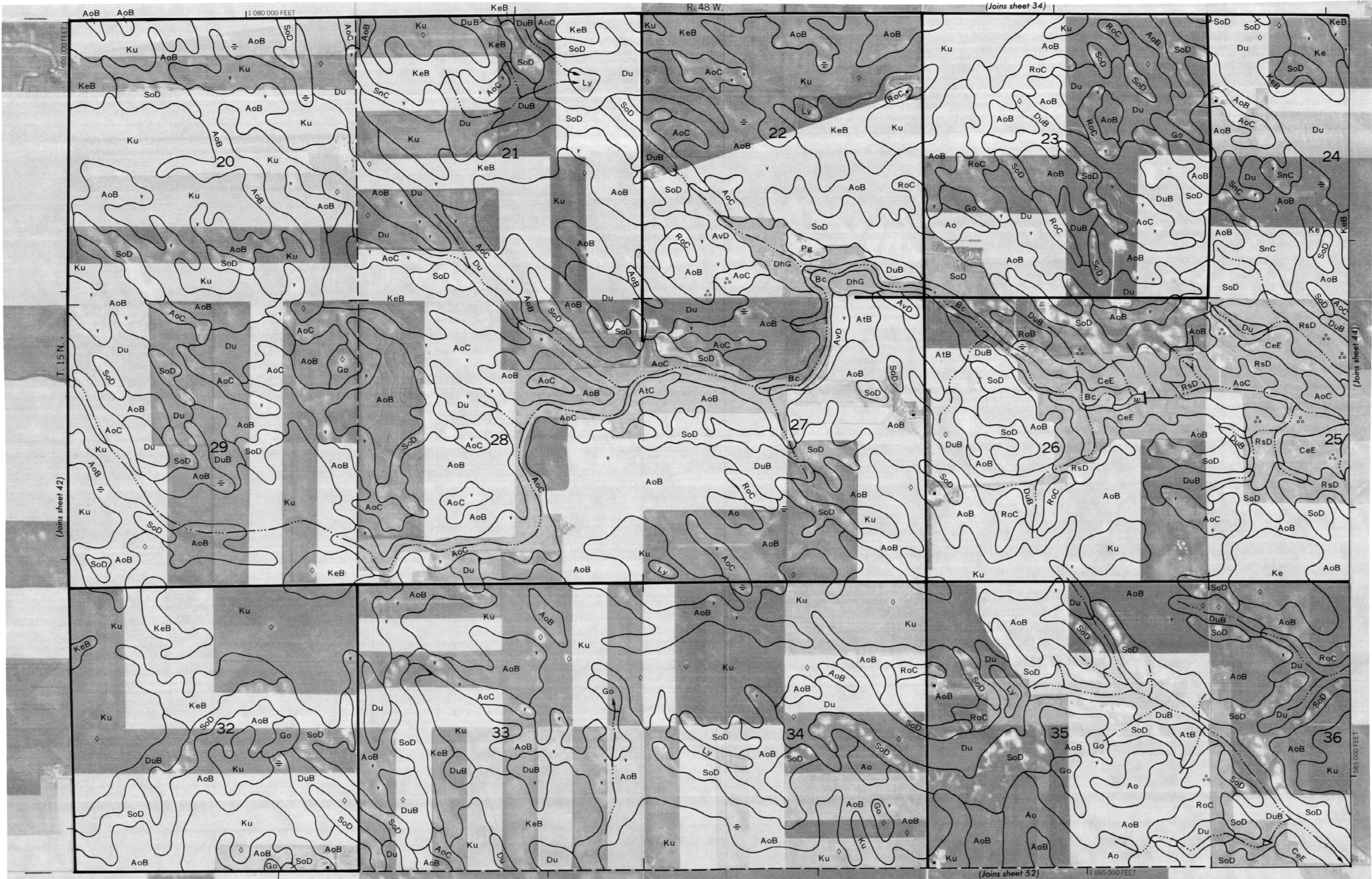


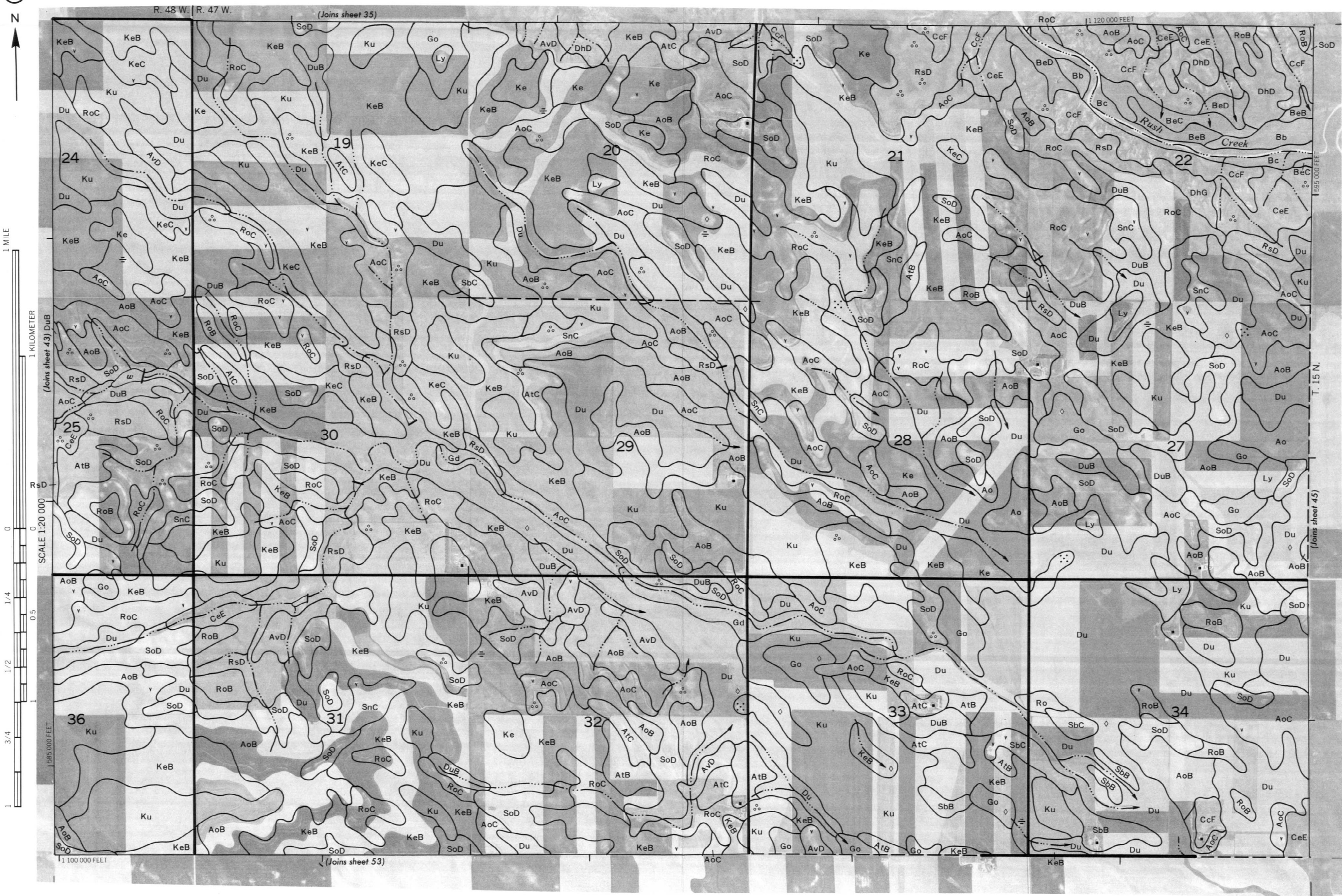
CHEYENNE COUNTY, NEBRASKA NO. 42

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps were prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 43



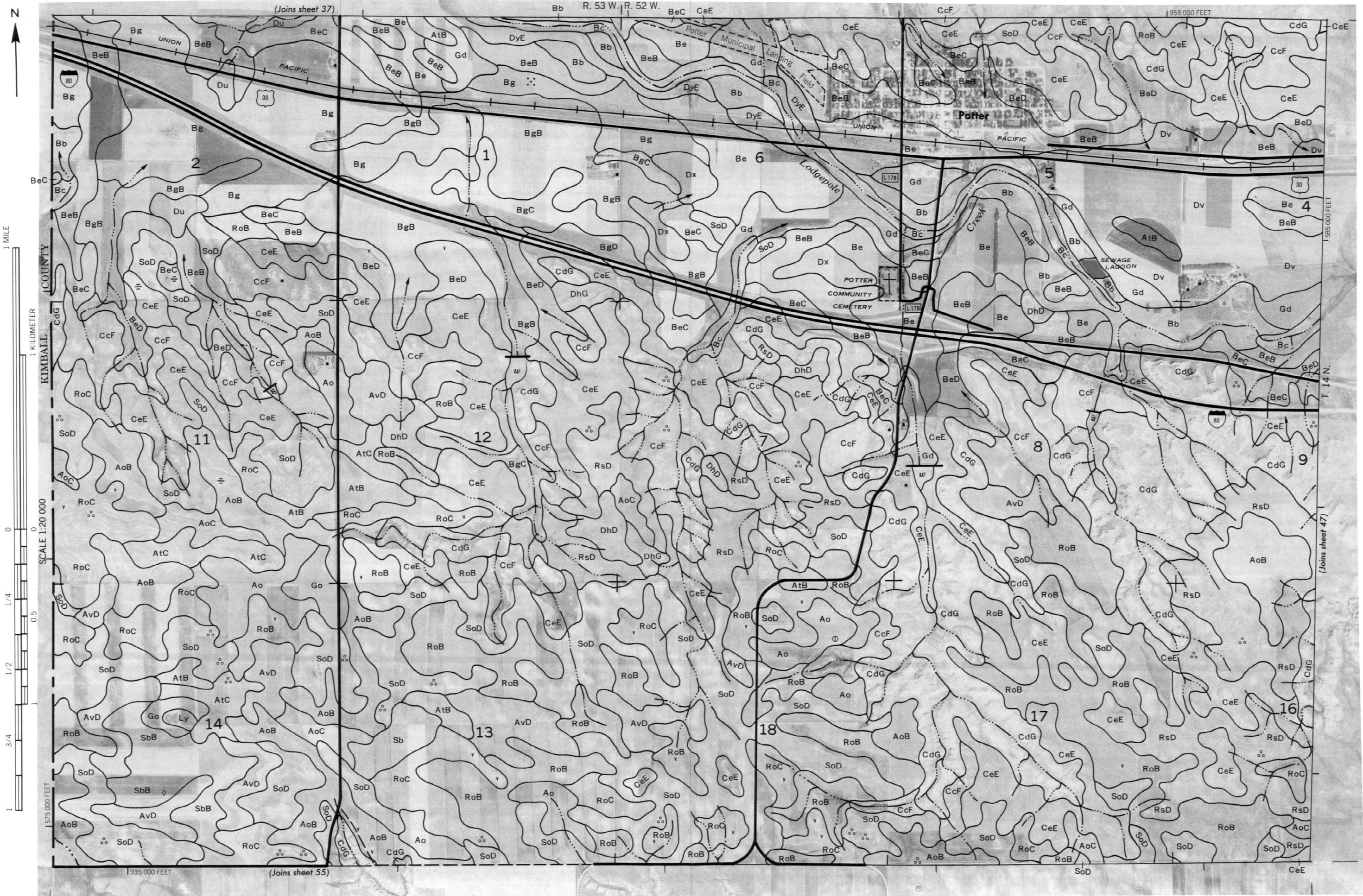


CHEYENNE COUNTY, NEBRASKA NO. 44

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

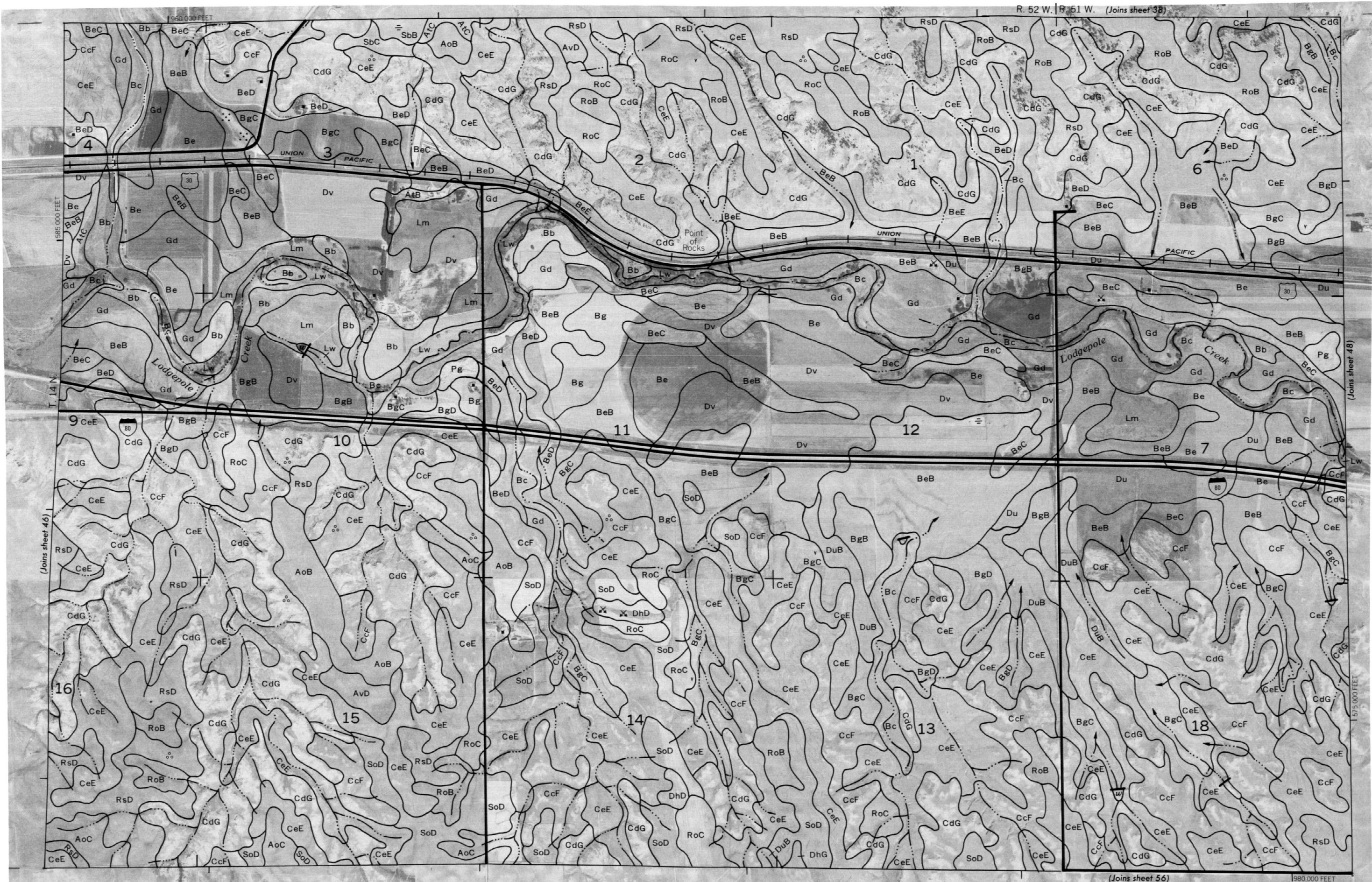
CHEYENNE COUNTY, NEBRASKA NO. 45



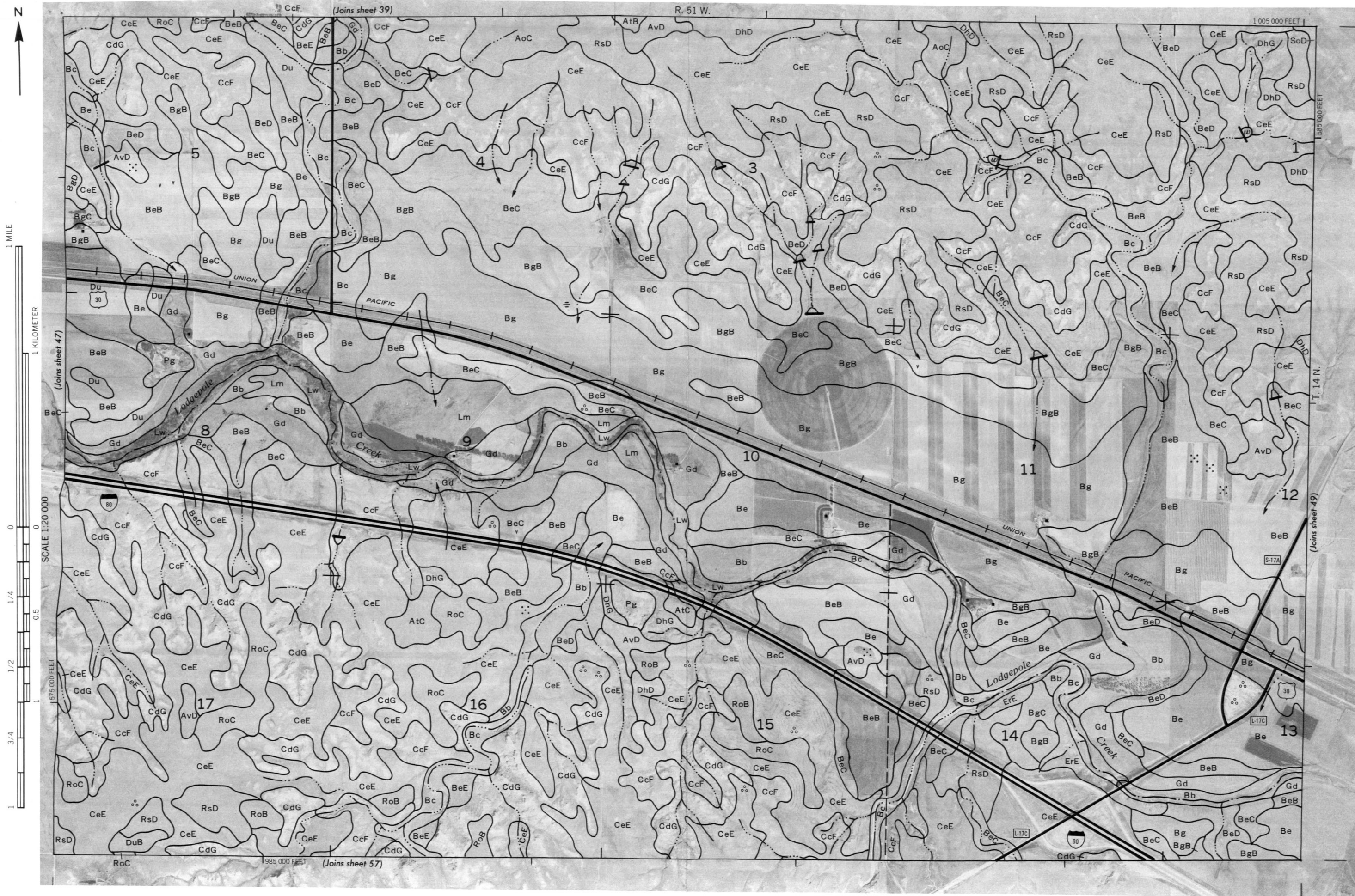


This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps were prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 47

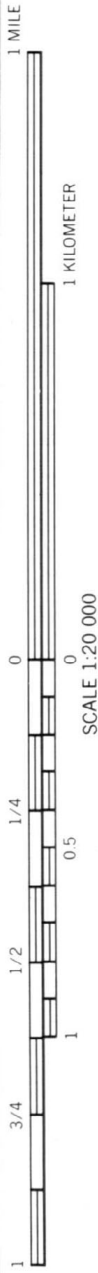
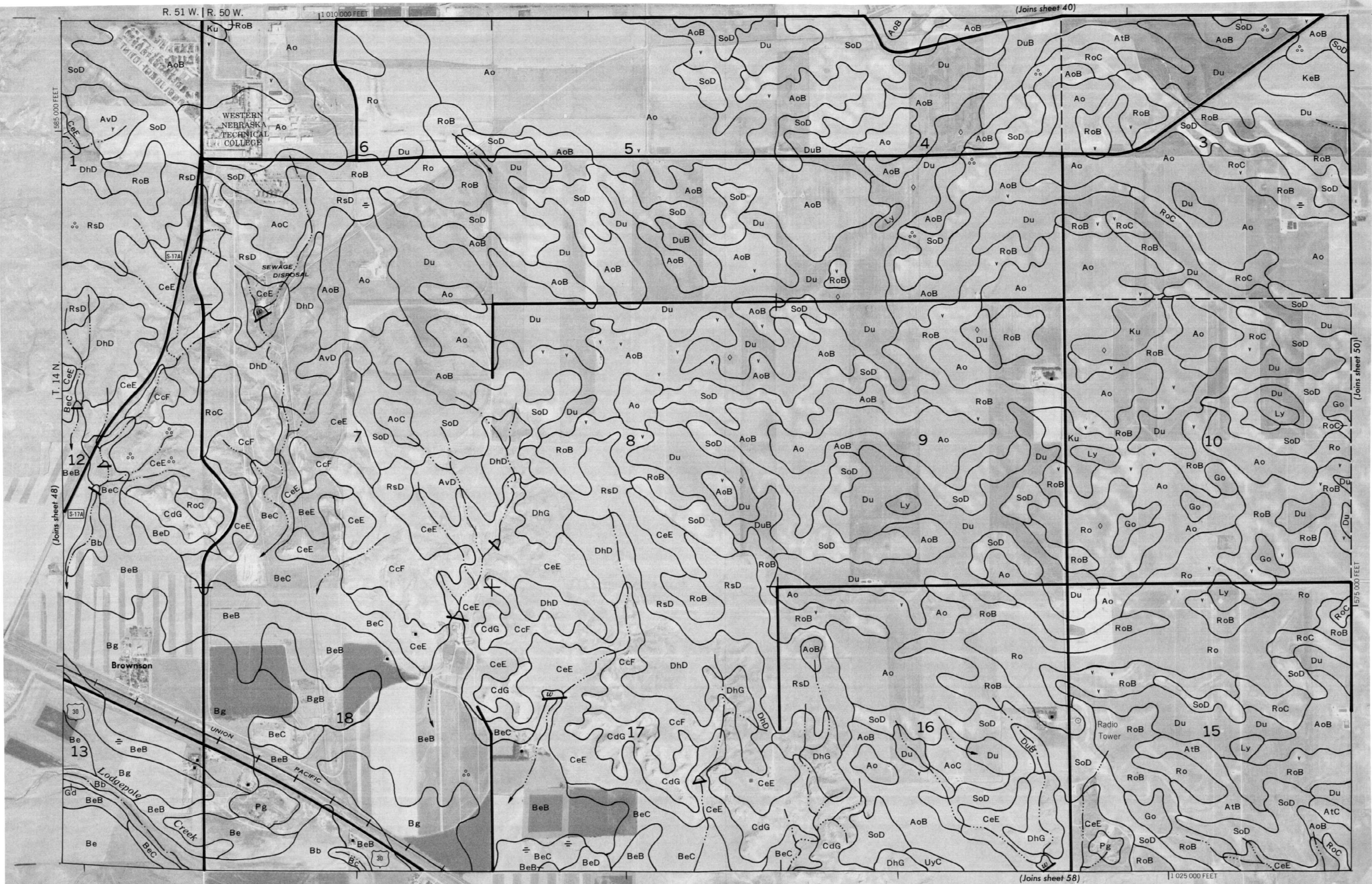


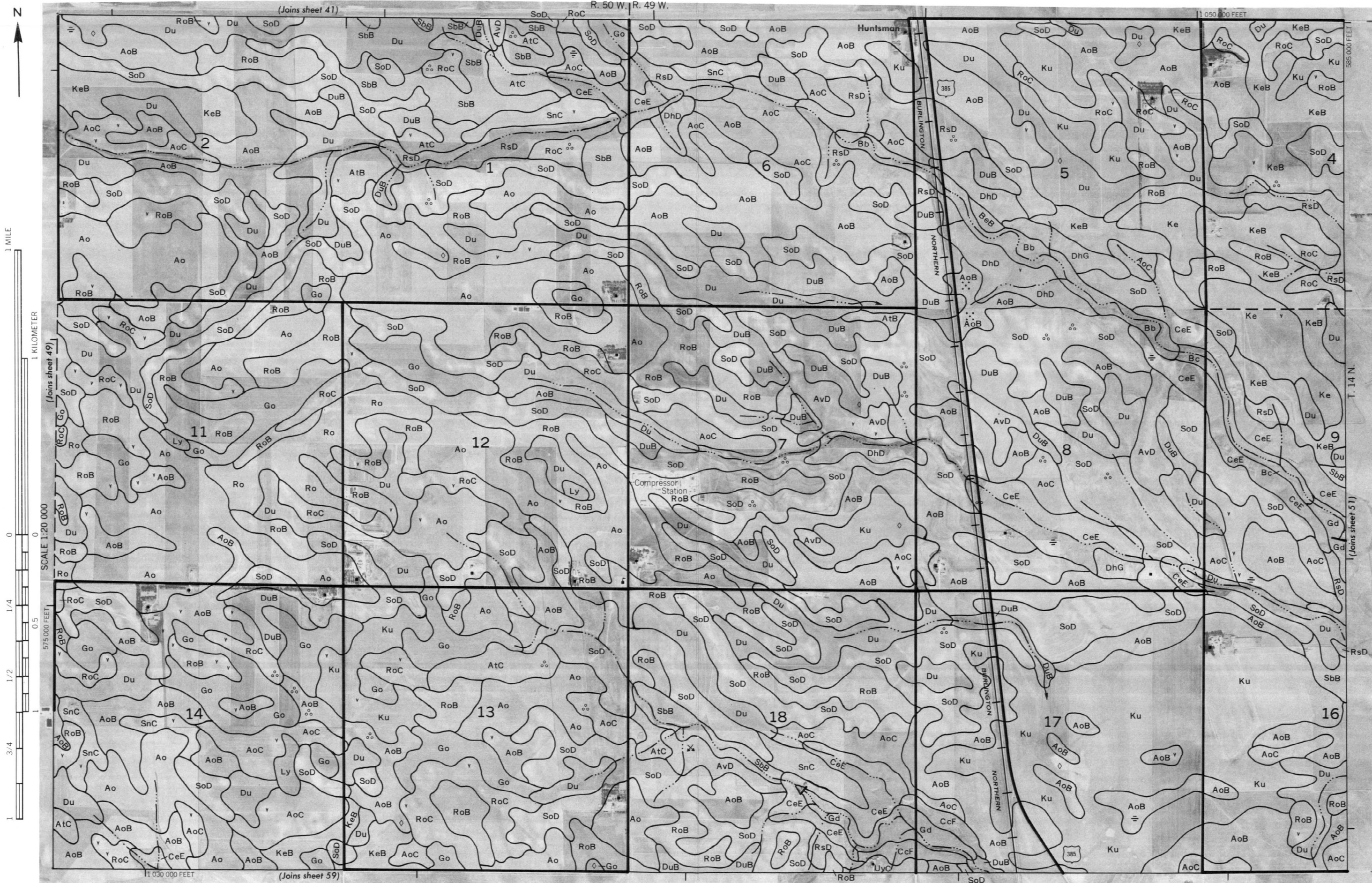
SCALE 1:20 000



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

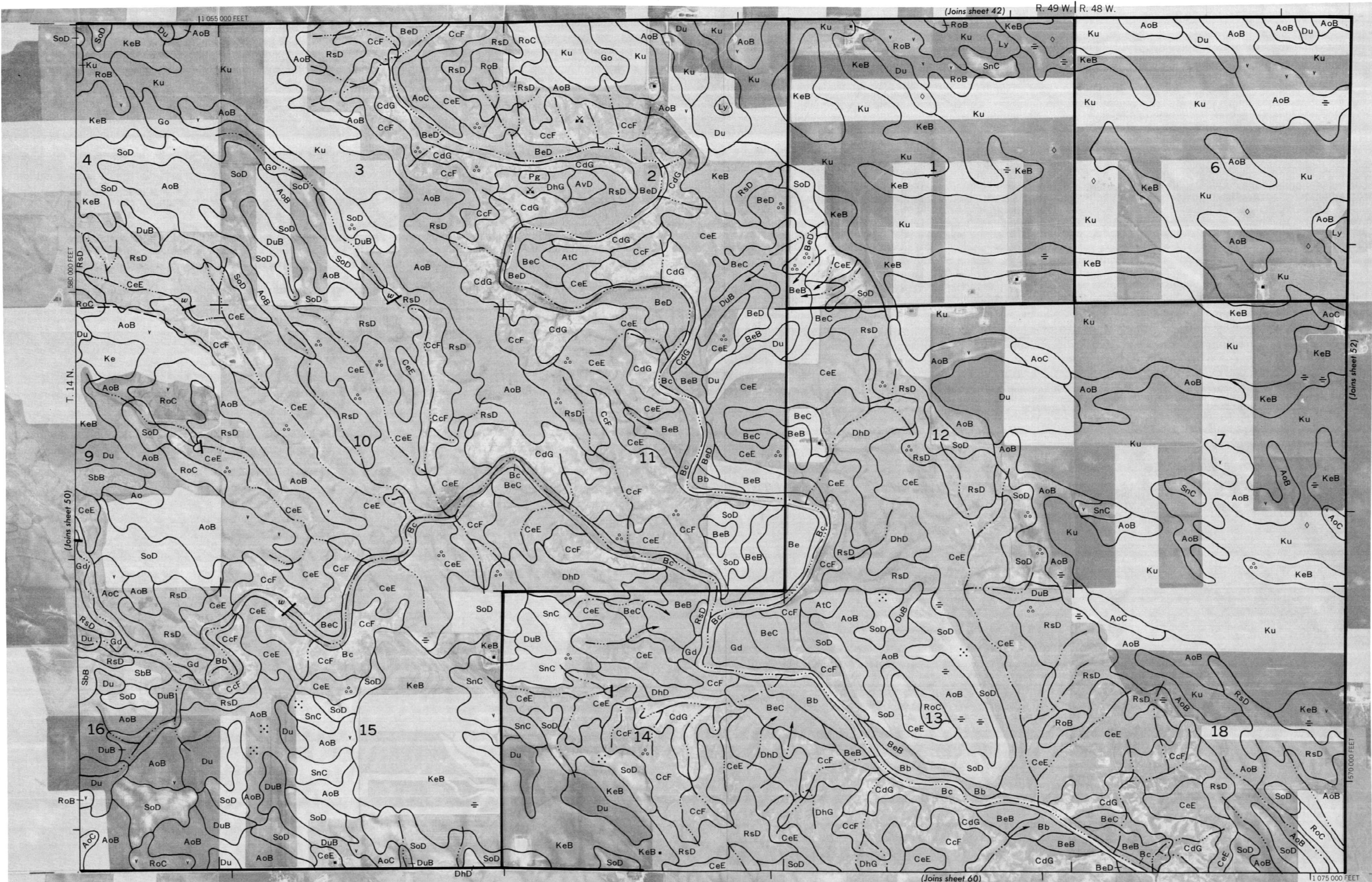
CHEYENNE COUNTY, NEBRASKA NO. 49

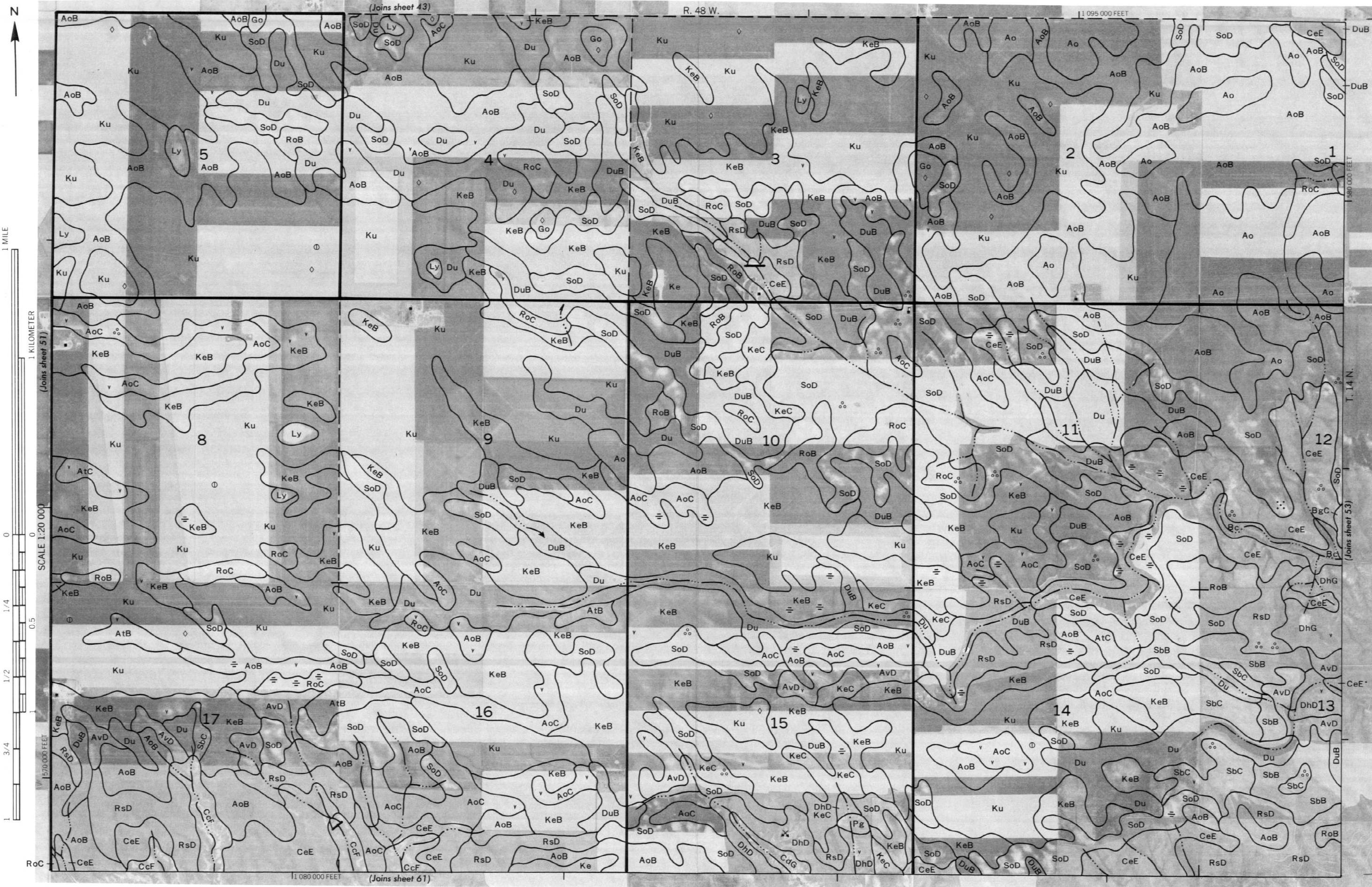




CHEYENNE COUNTY, NEBRASKA NO. 51

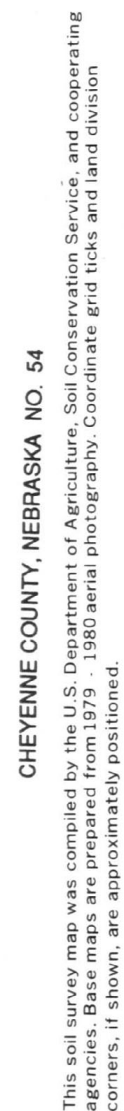
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





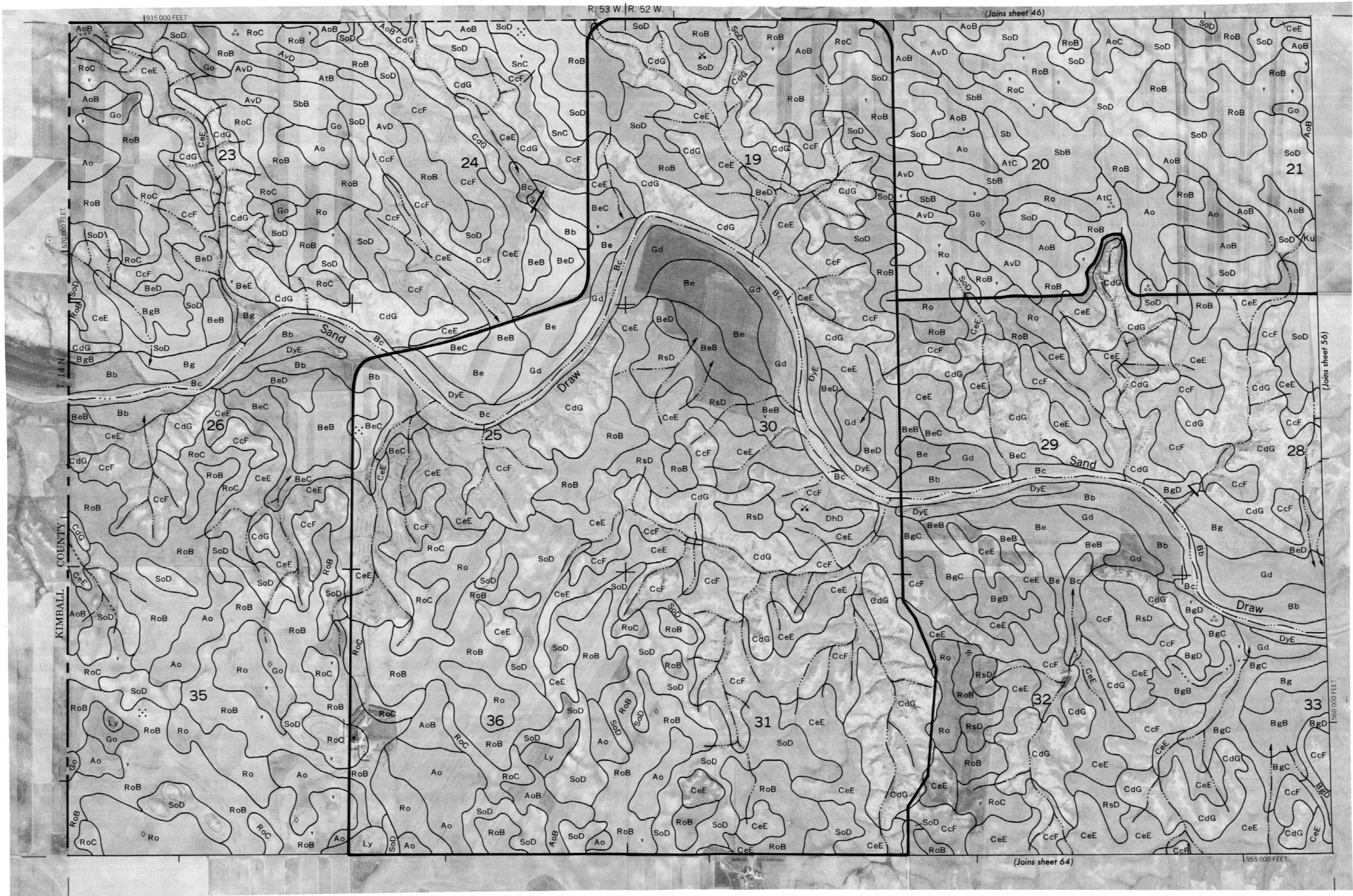


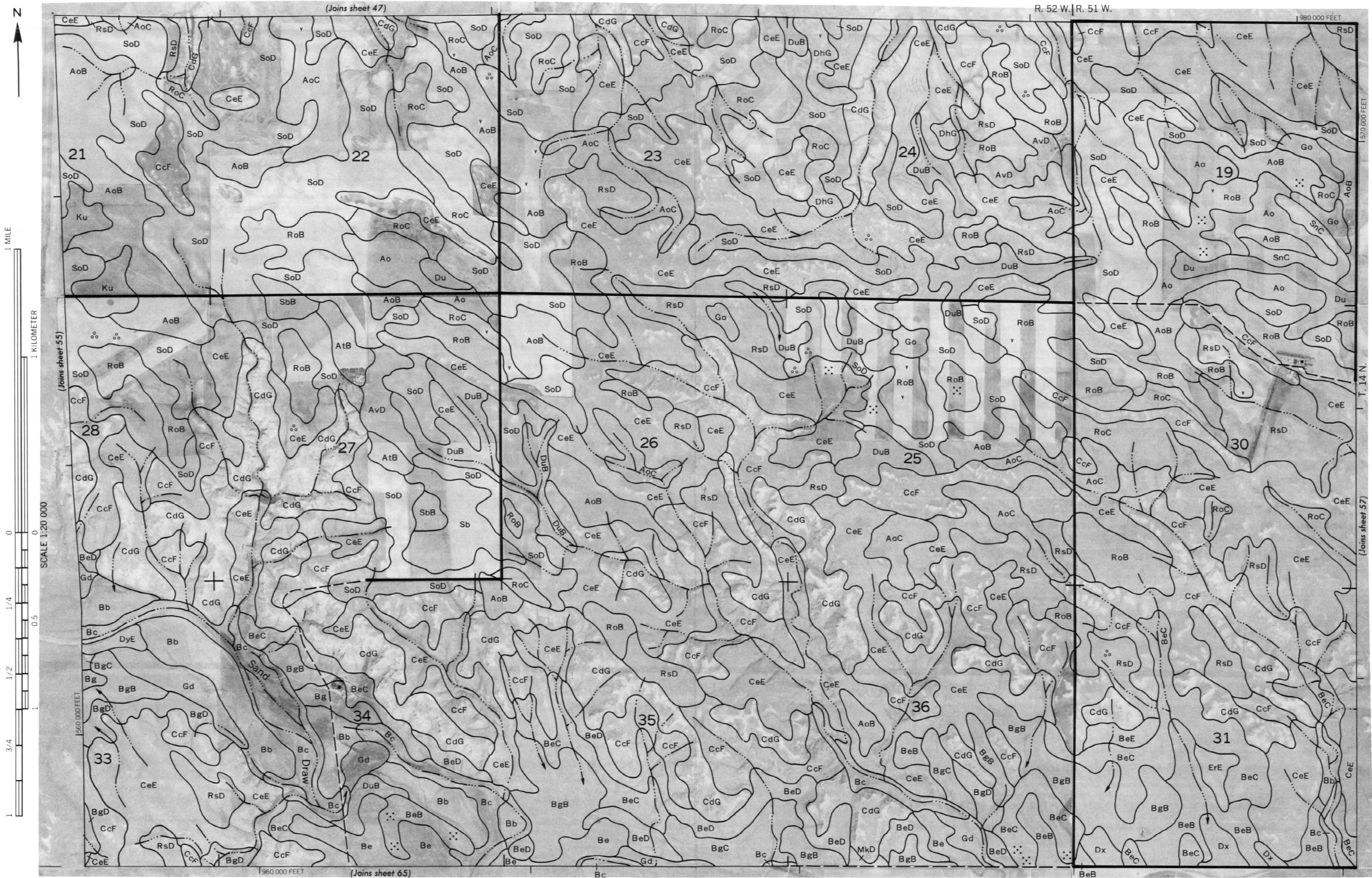
CHEYENNE COUNTY, NEBRASKA NO. 53



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 55





This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 57

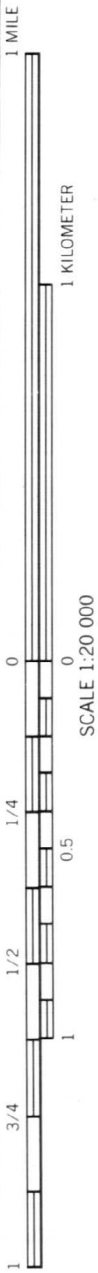
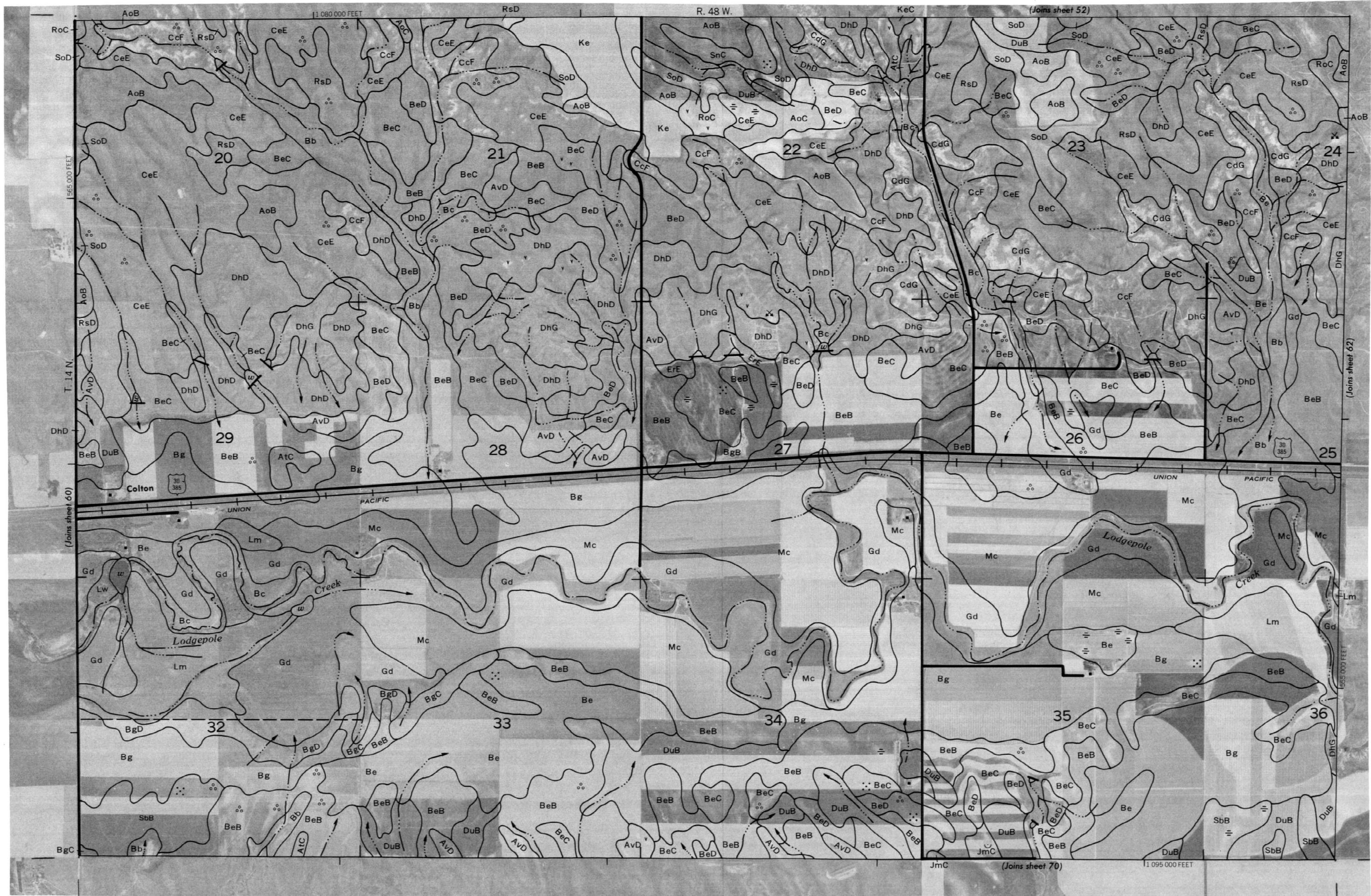


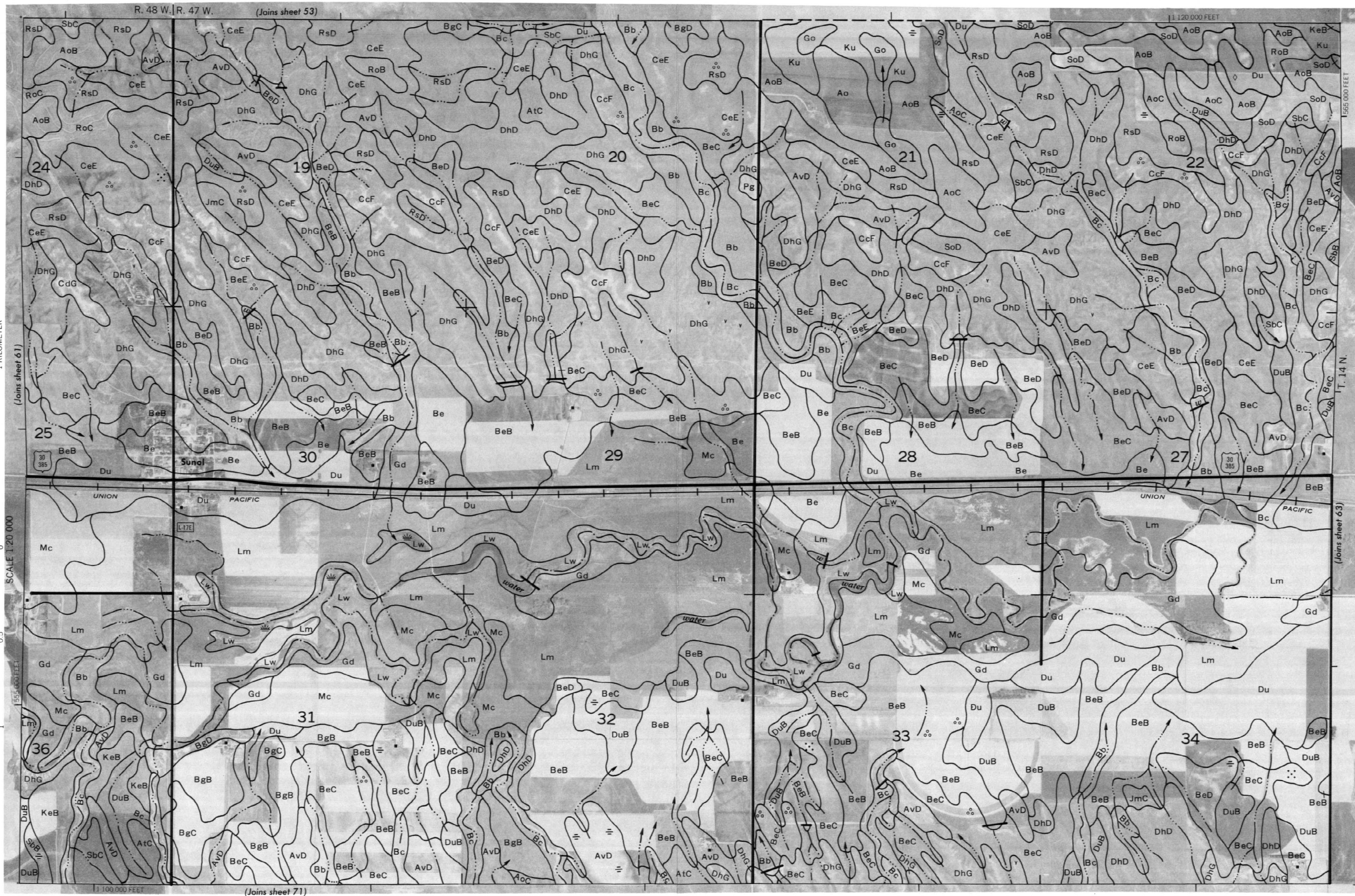




This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

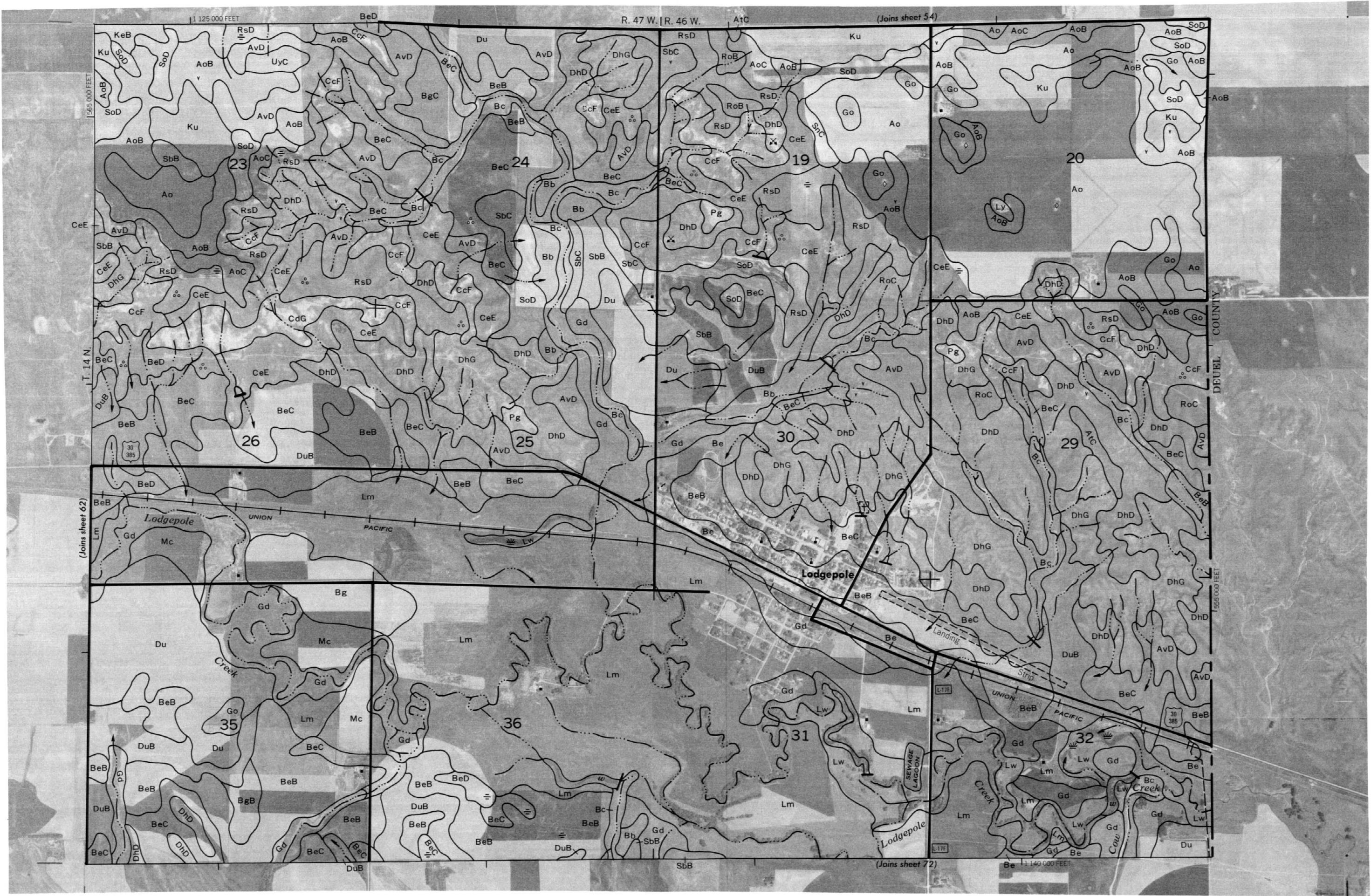
CHEYENNE COUNTY, NEBRASKA NO. 61

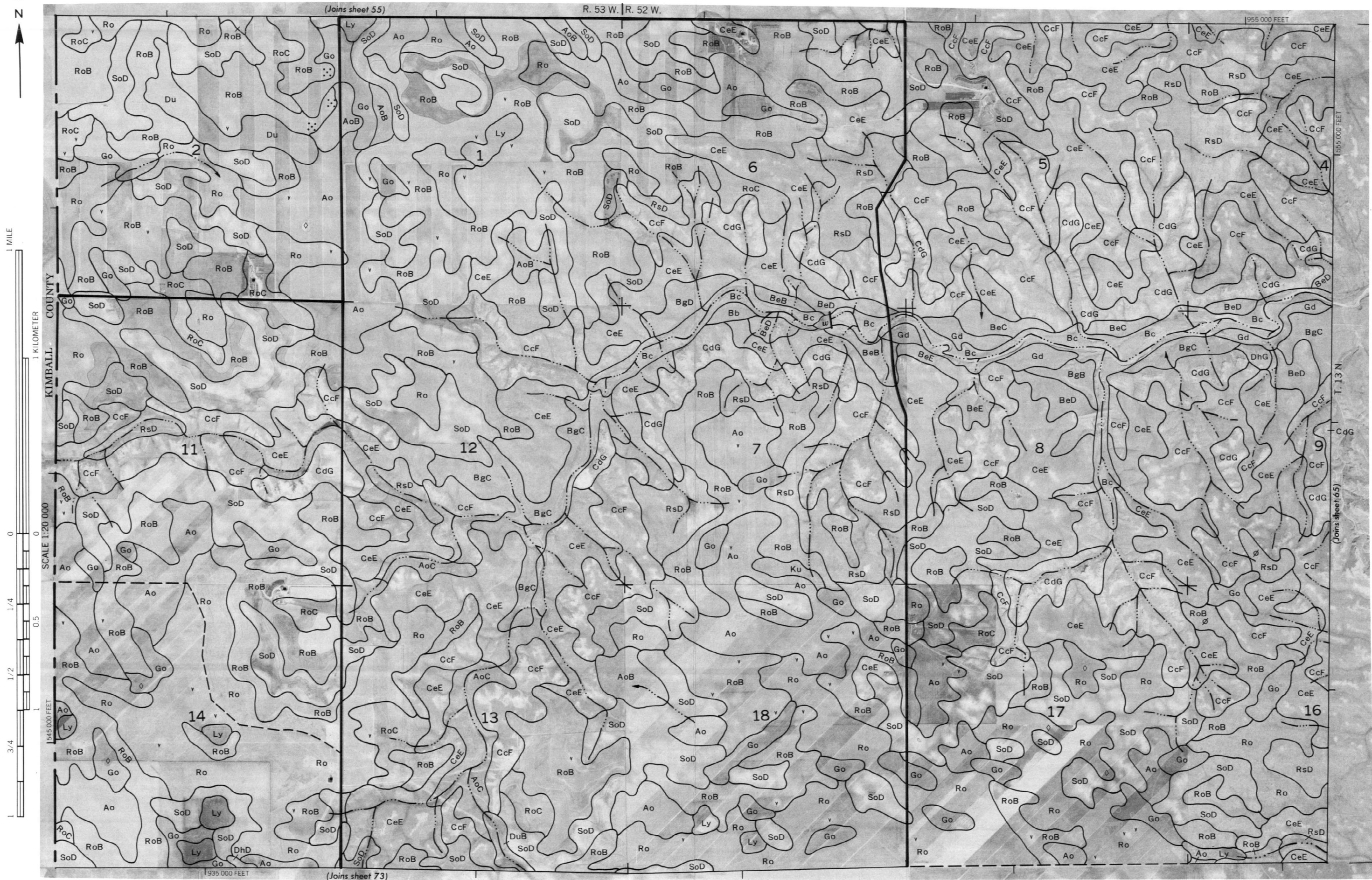




This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 63





R. 52 W. | R. 51 W.

1960 000 FEET

(Joins sheet 56)

1555 000 FEET

T. 13 N.

(Joins sheet 64)

16

3

11

12

18

15

14

13

6

7

Sand

Draw

1 MILE

1 KILOMETER

SCALE 1:20 000

0.5

1

3/4

1/2

1/4

0

0



(Joins sheet 66)

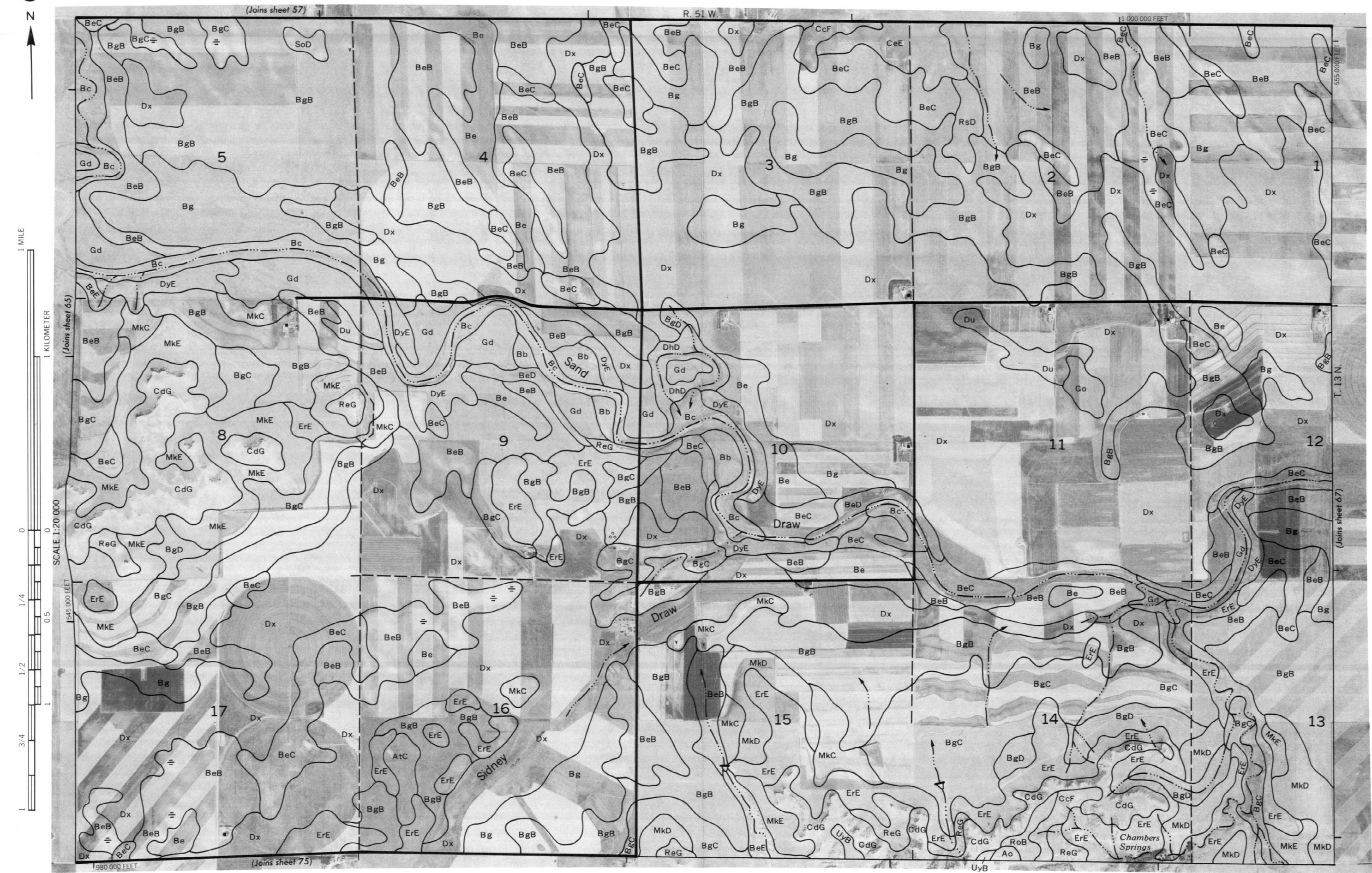
1545 000 FEET

1975 000 FEET

(Joins sheet 74)

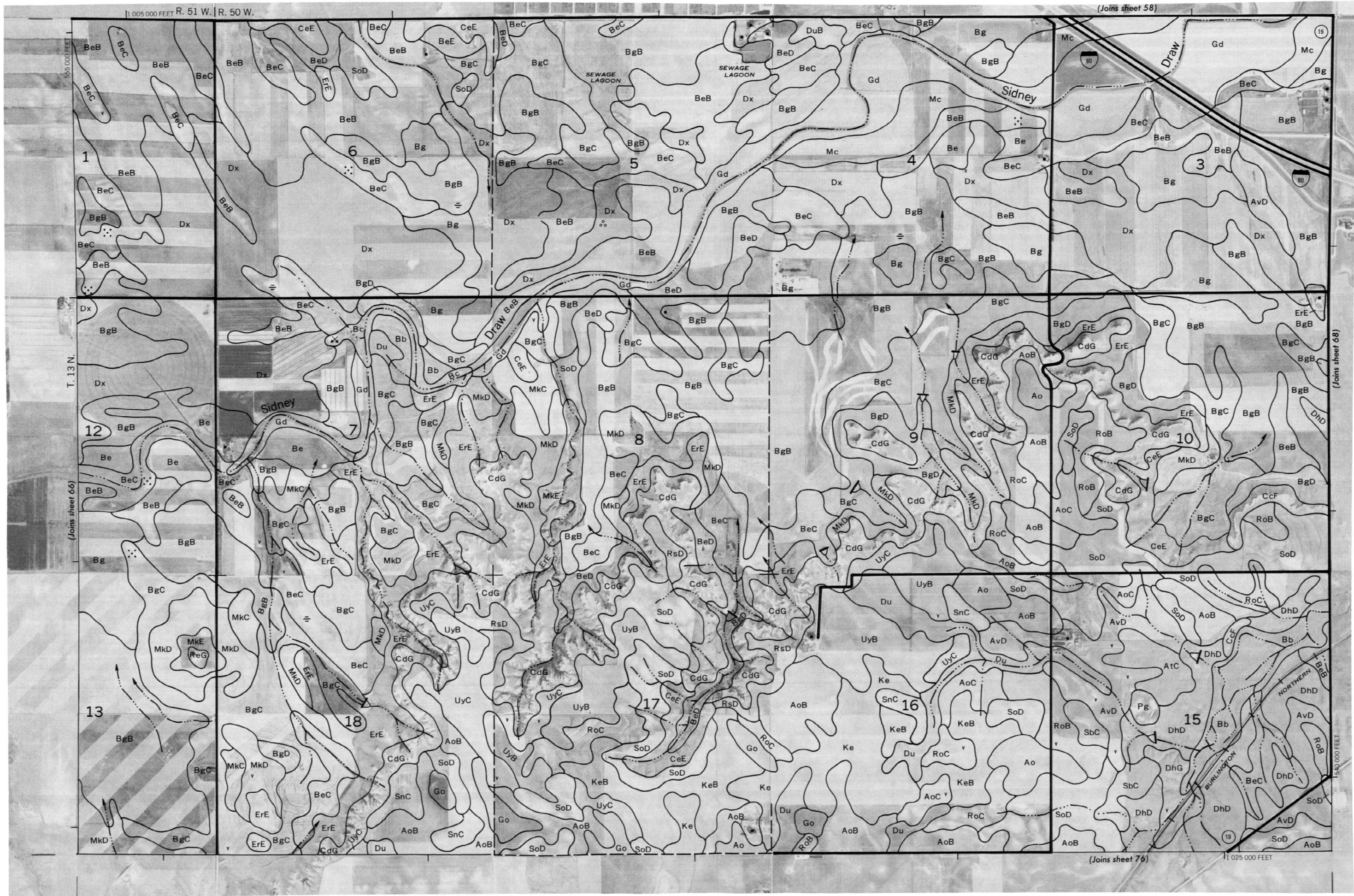
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

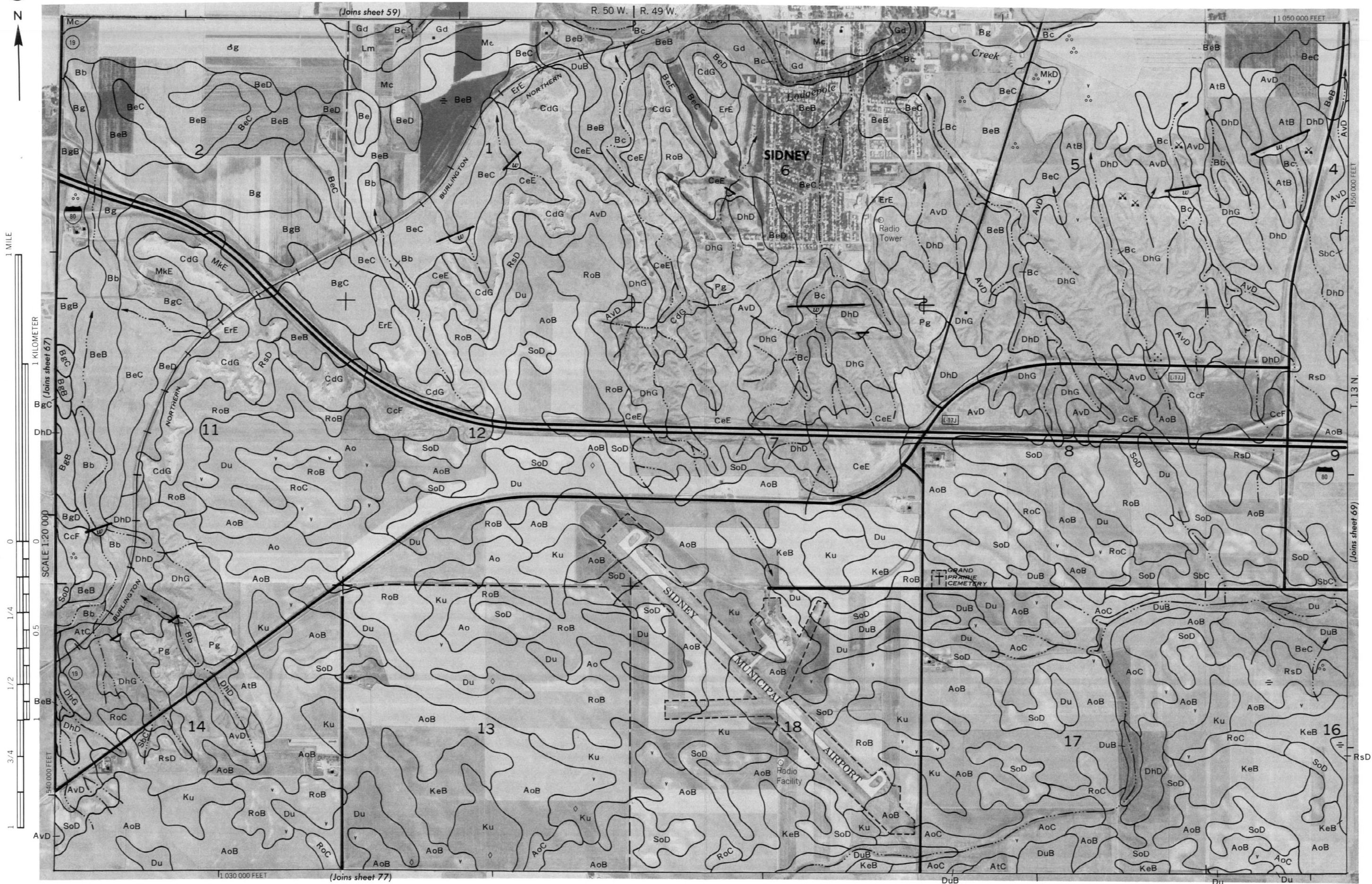
CHEYENNE COUNTY, NEBRASKA NO. 65



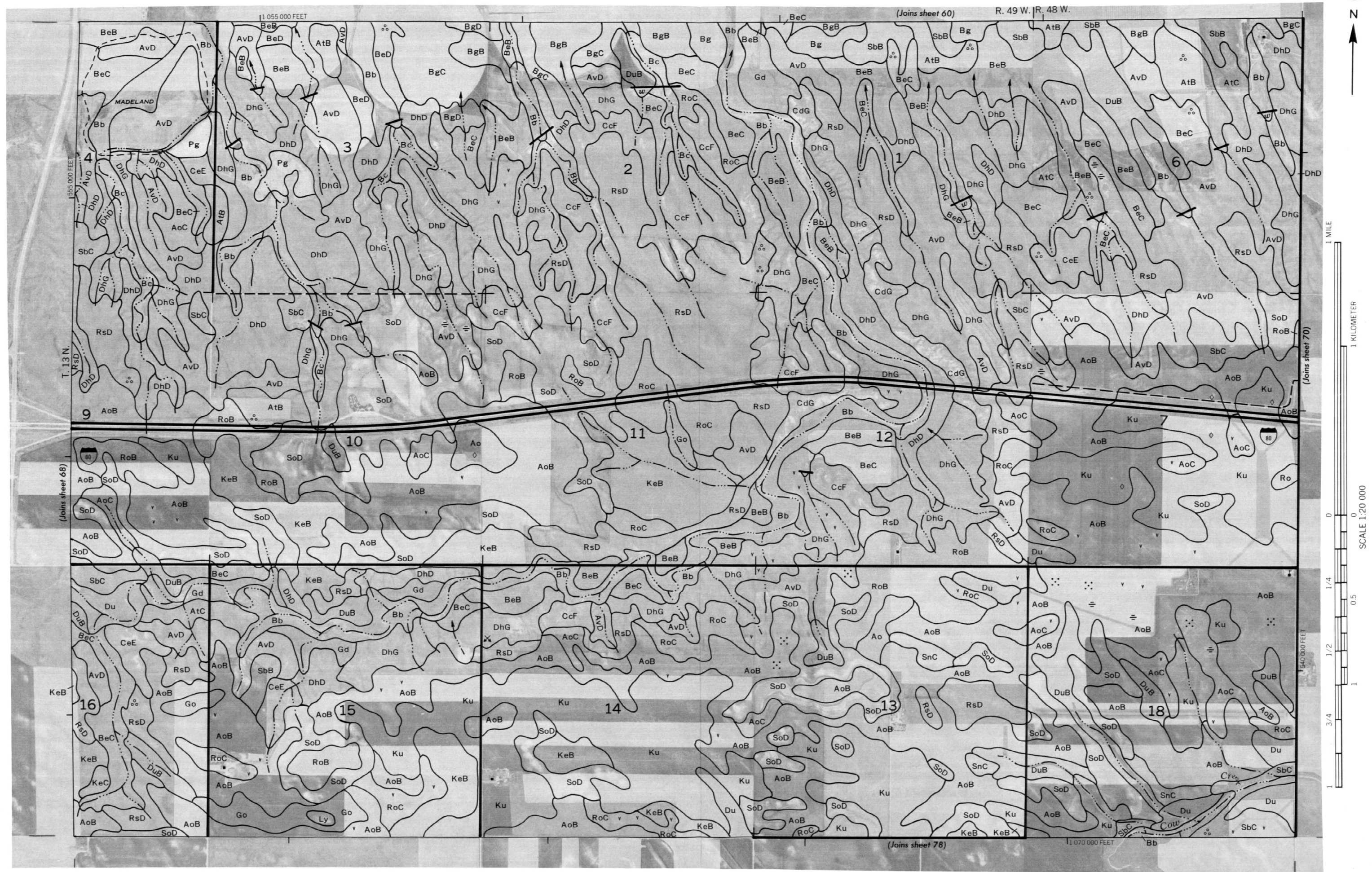
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

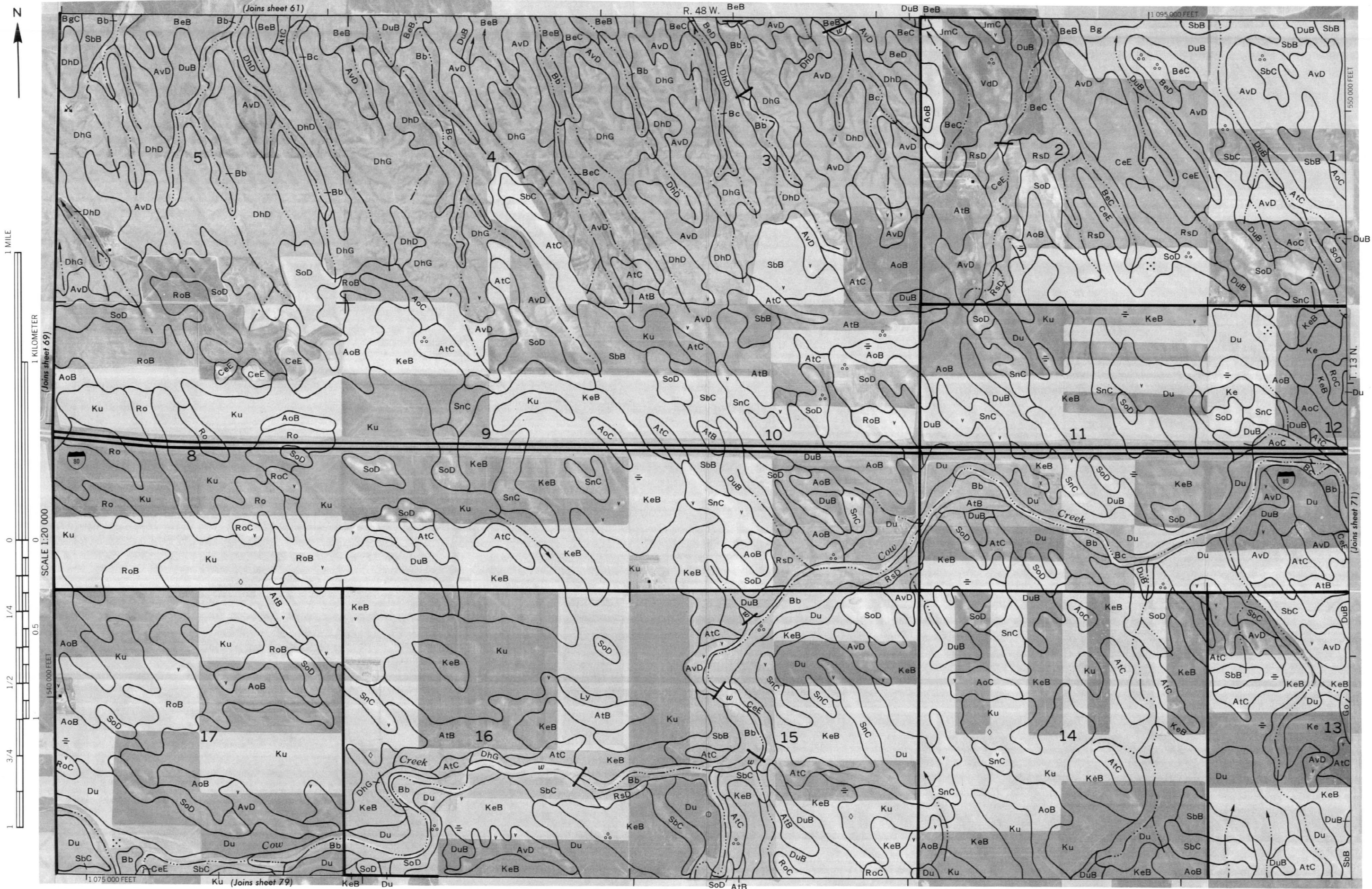
CHEYENNE COUNTY, NEBRASKA NO. 67



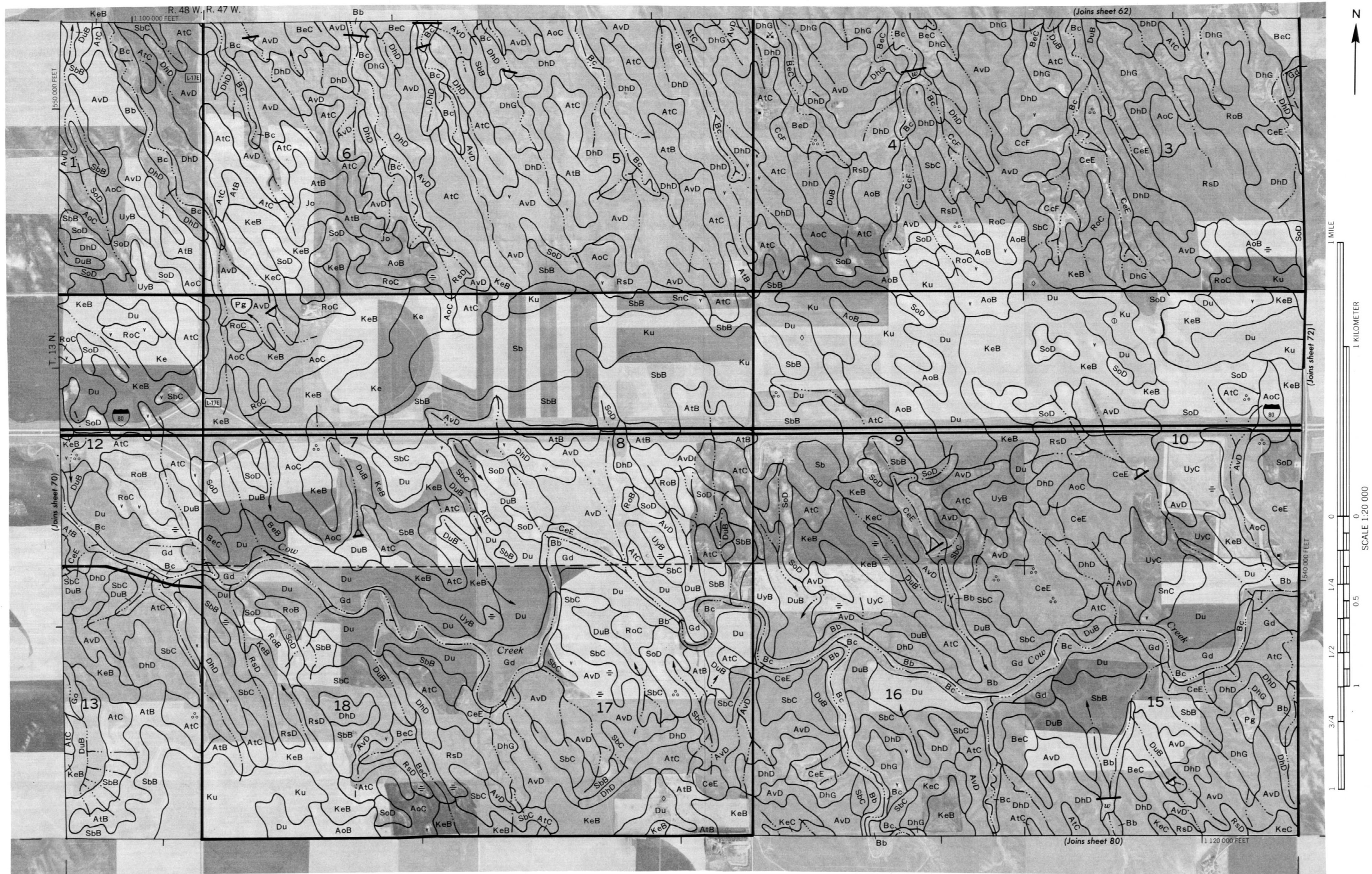


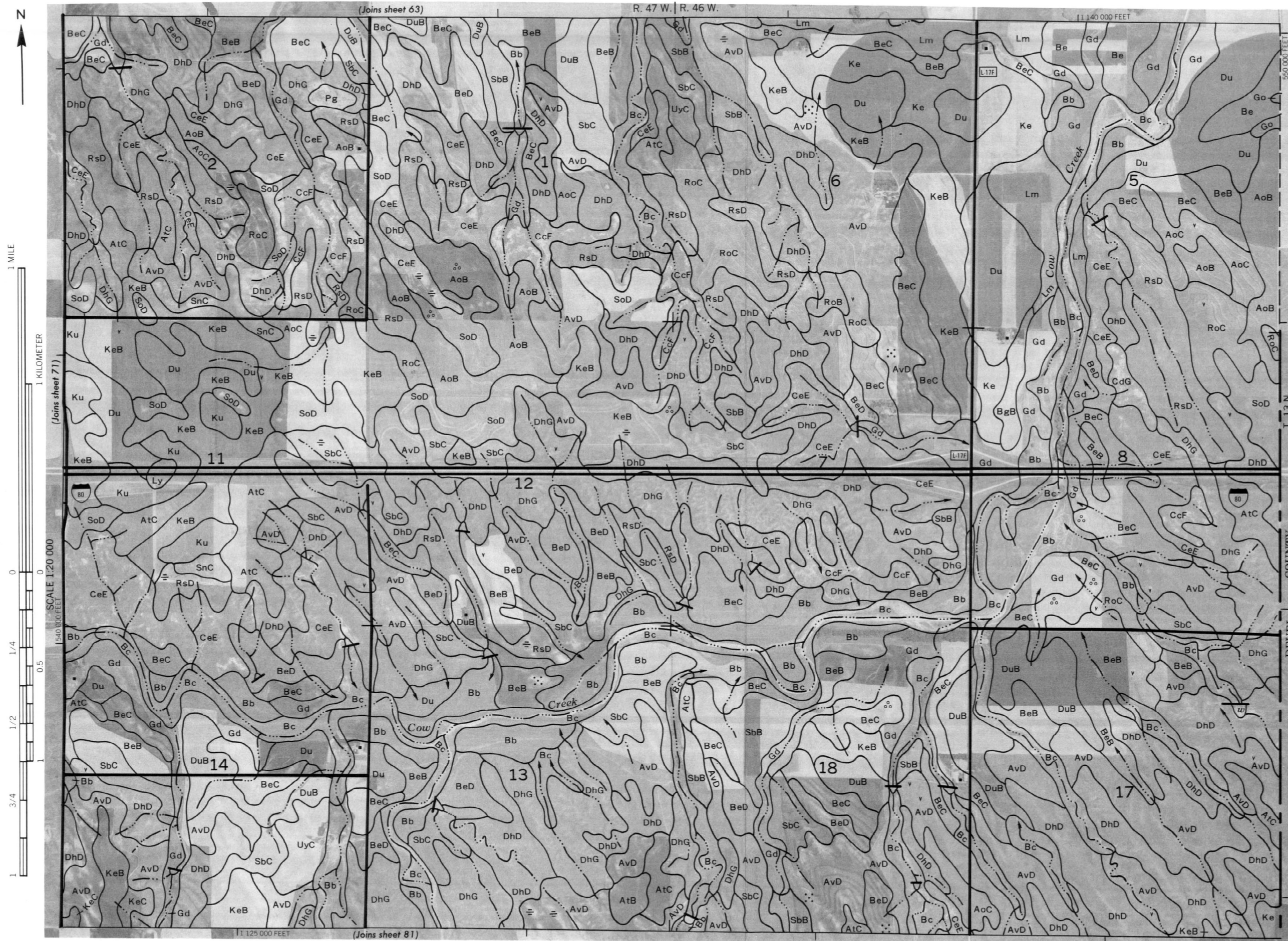
CHEYENNE COUNTY, NEBRASKA NO. 69



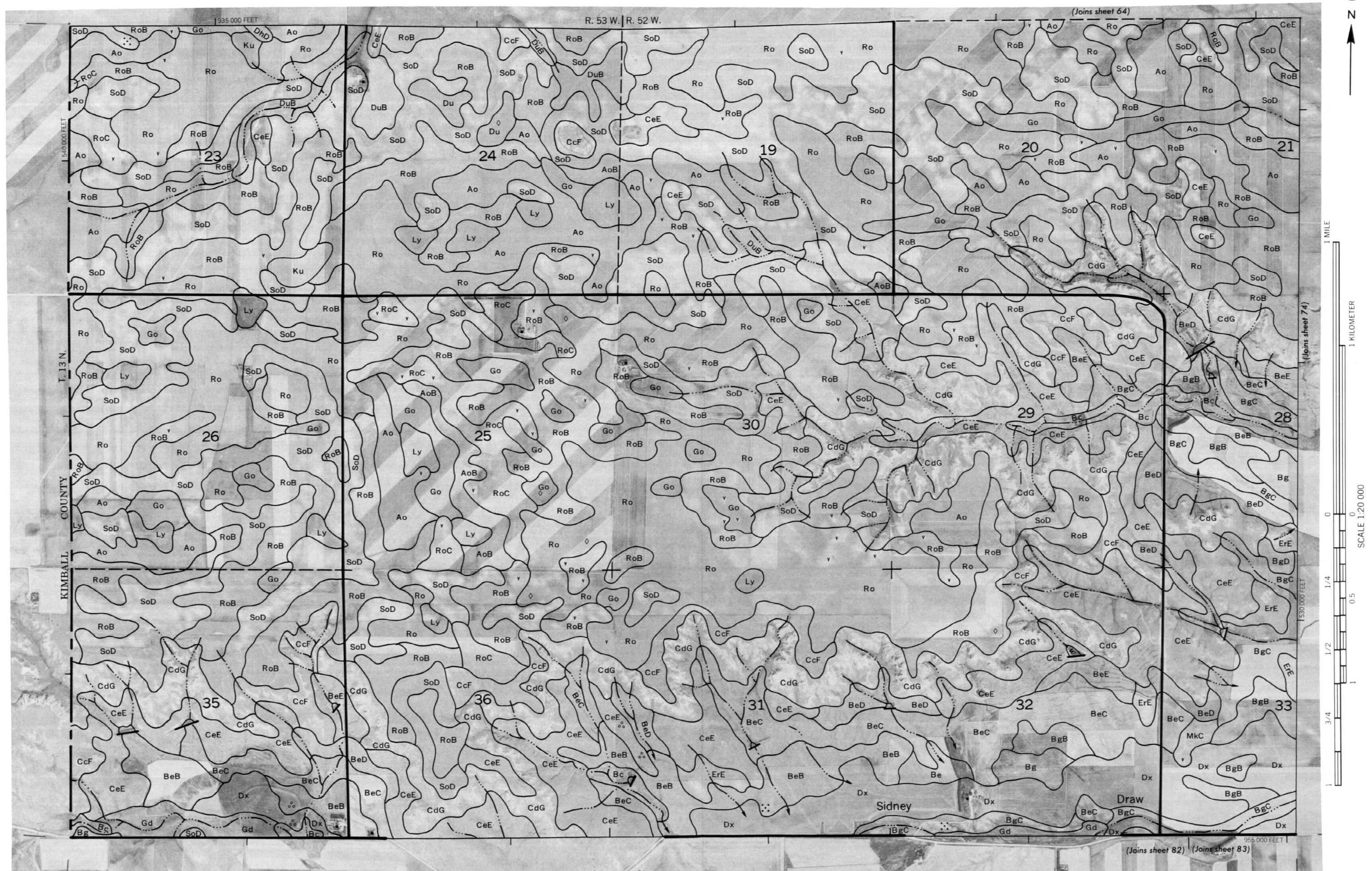


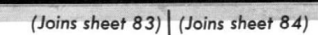
CHEYENNE COUNTY, NEBRASKA NO. 71

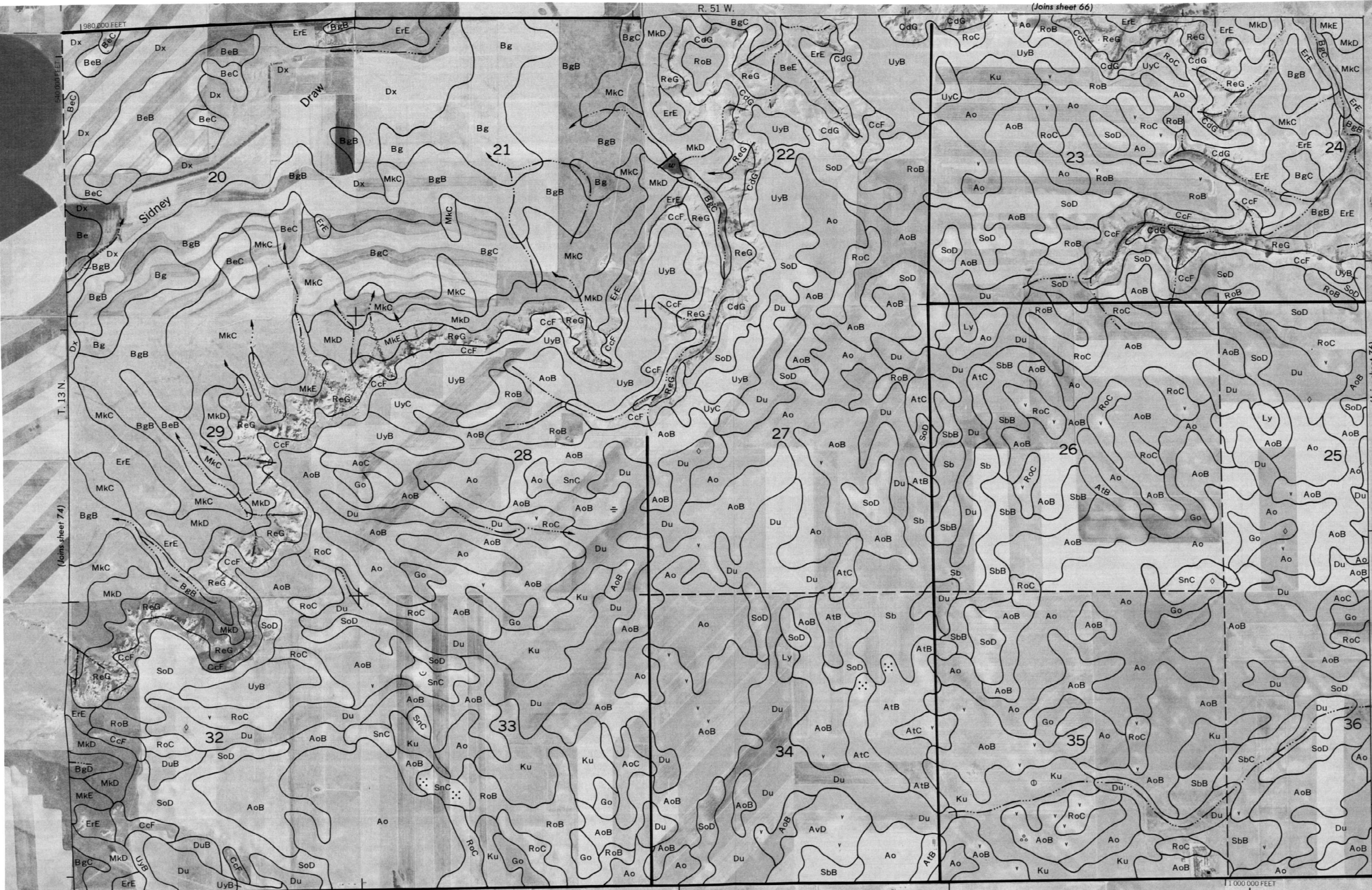




CHEYENNE COUNTY, NEBRASKA NO. 73



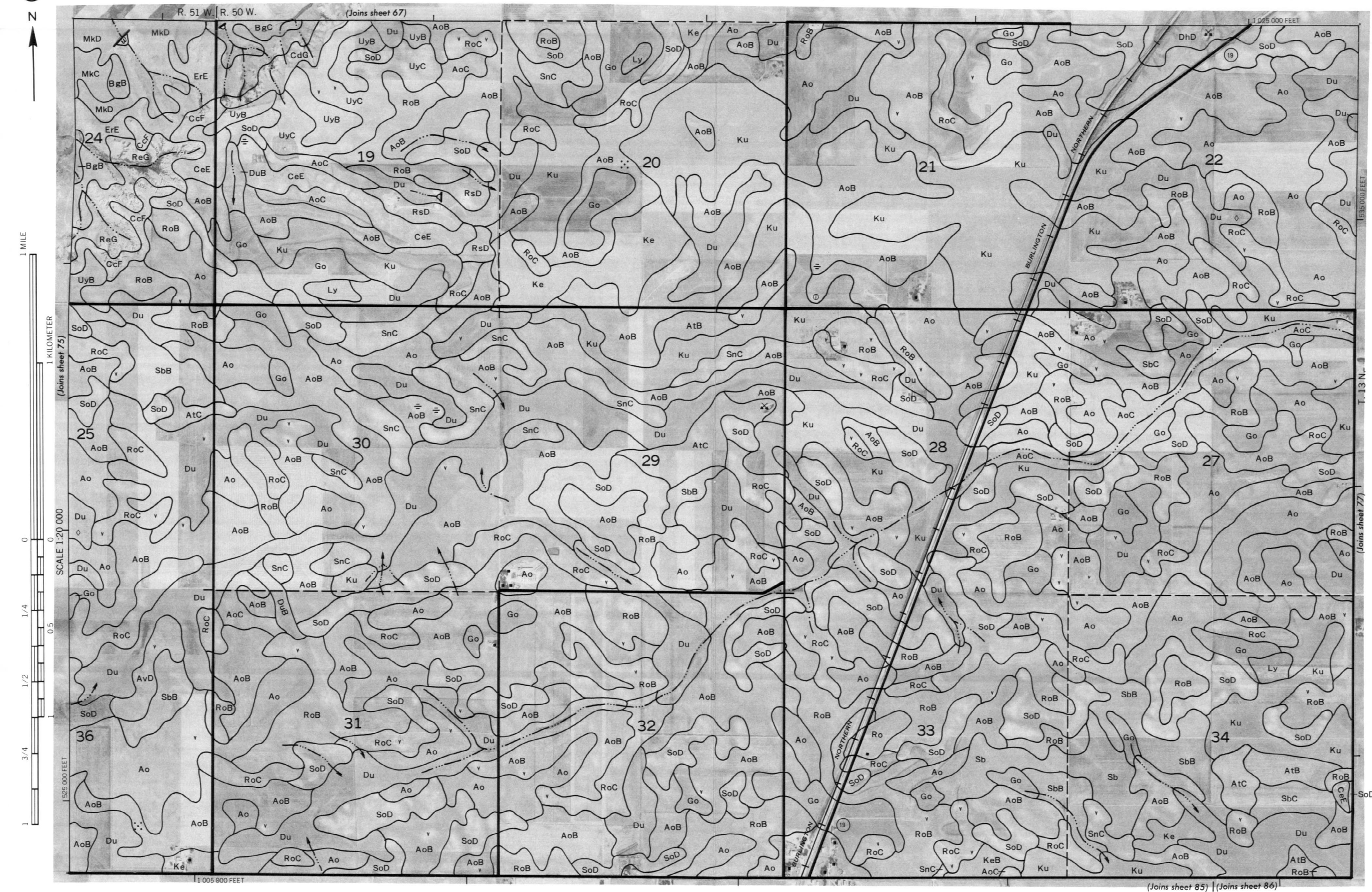


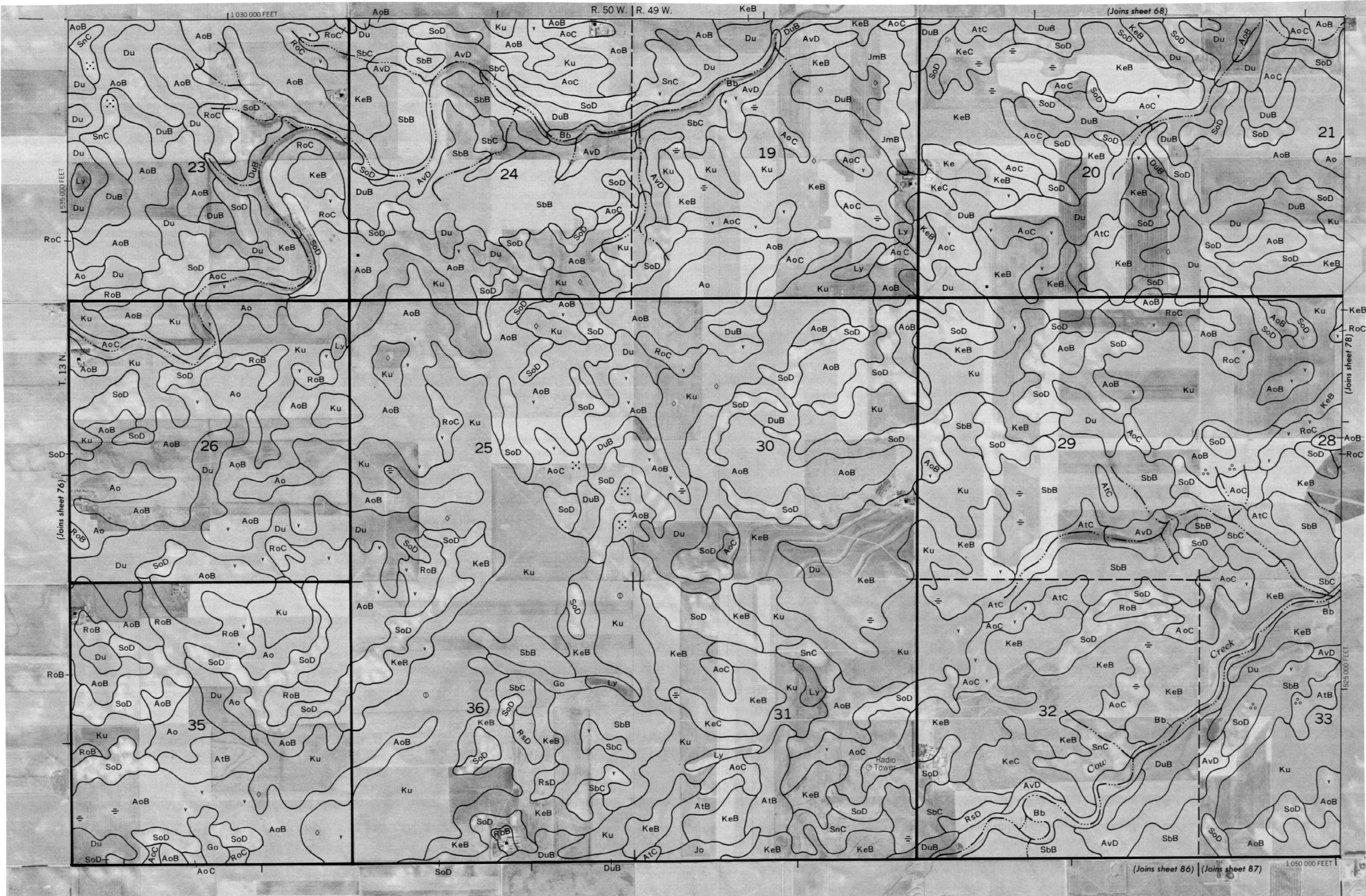


This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 75

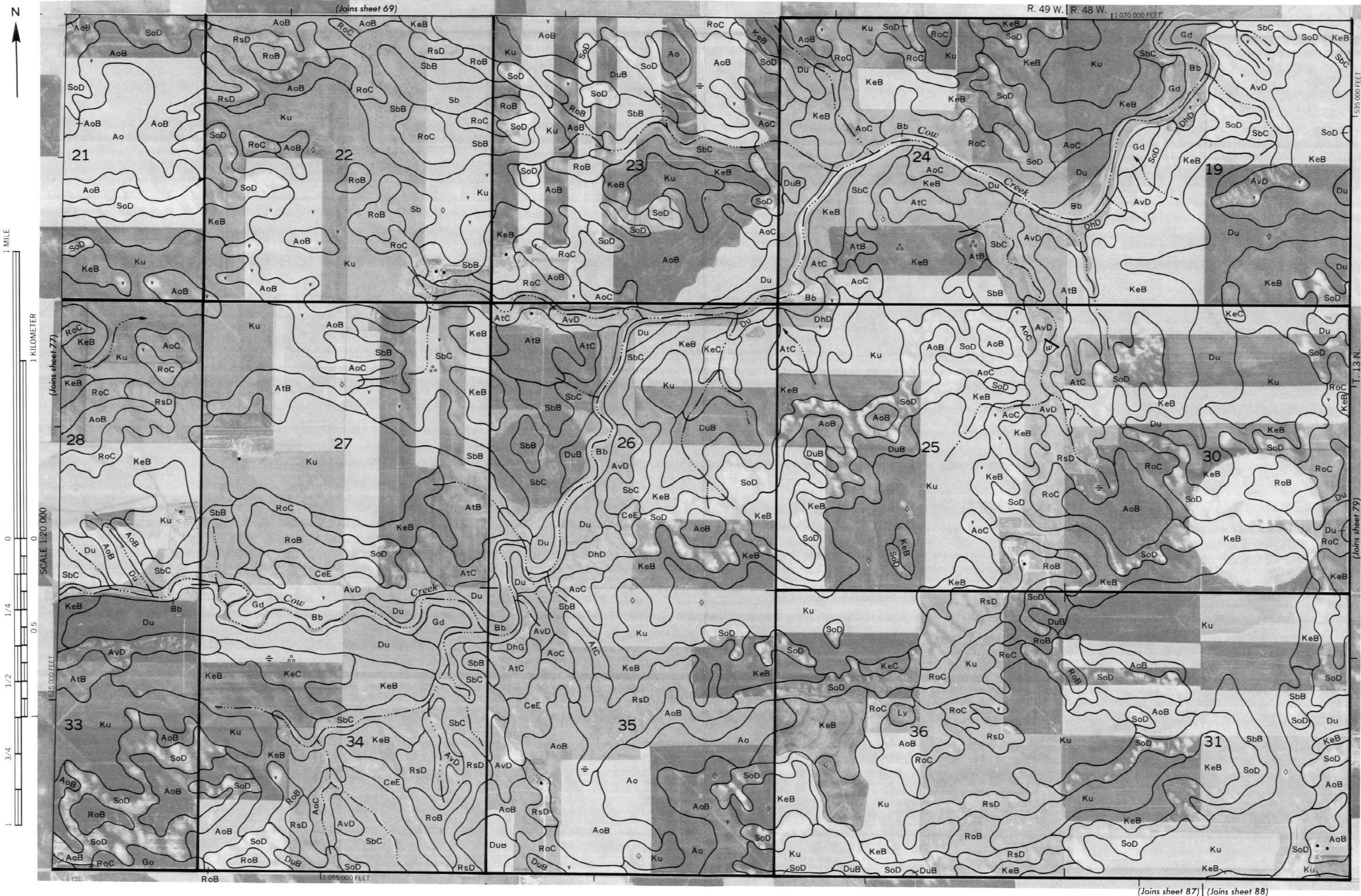
(Joins sheet 84) (Joins sheet 85)





This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 77

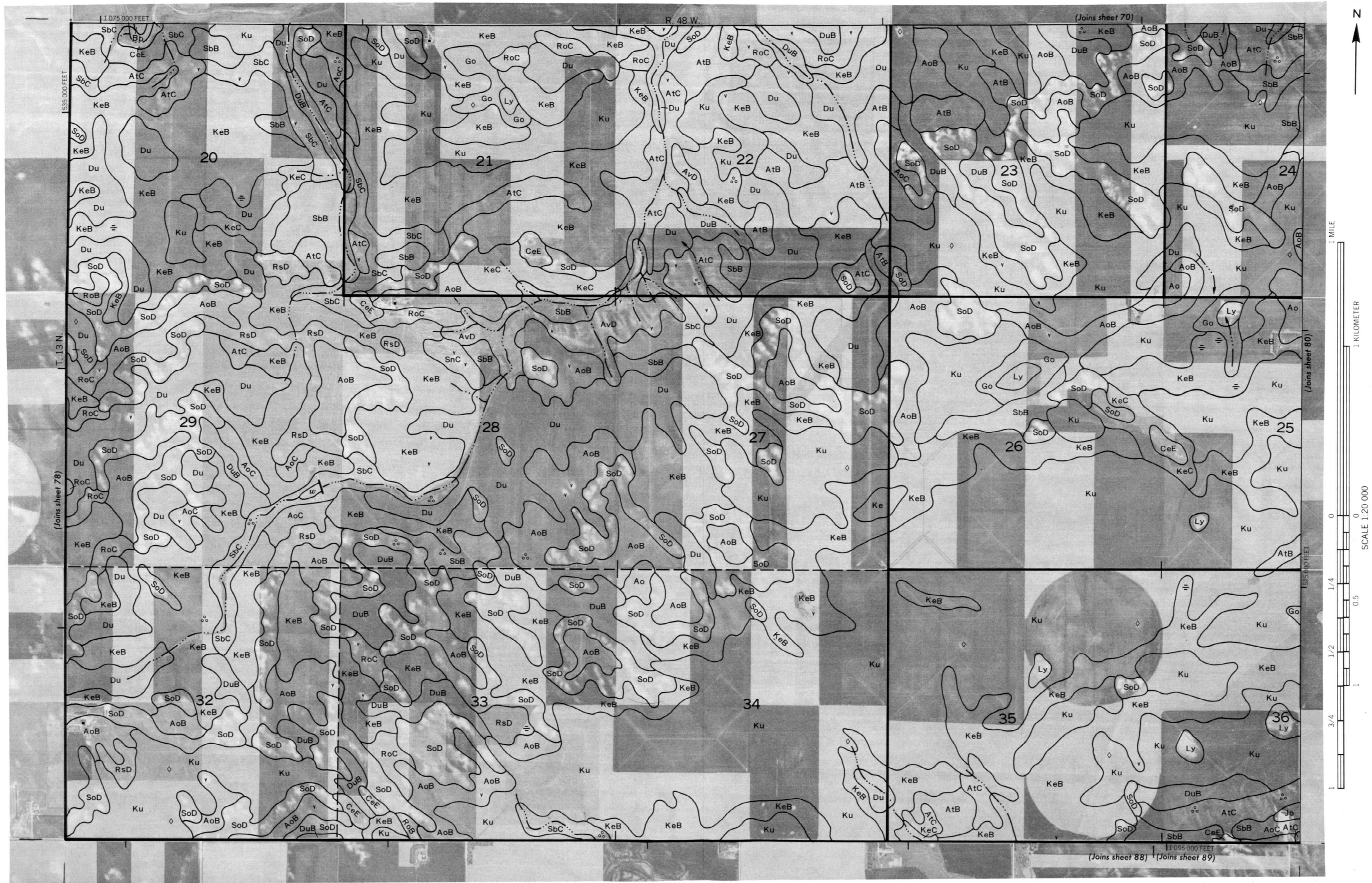


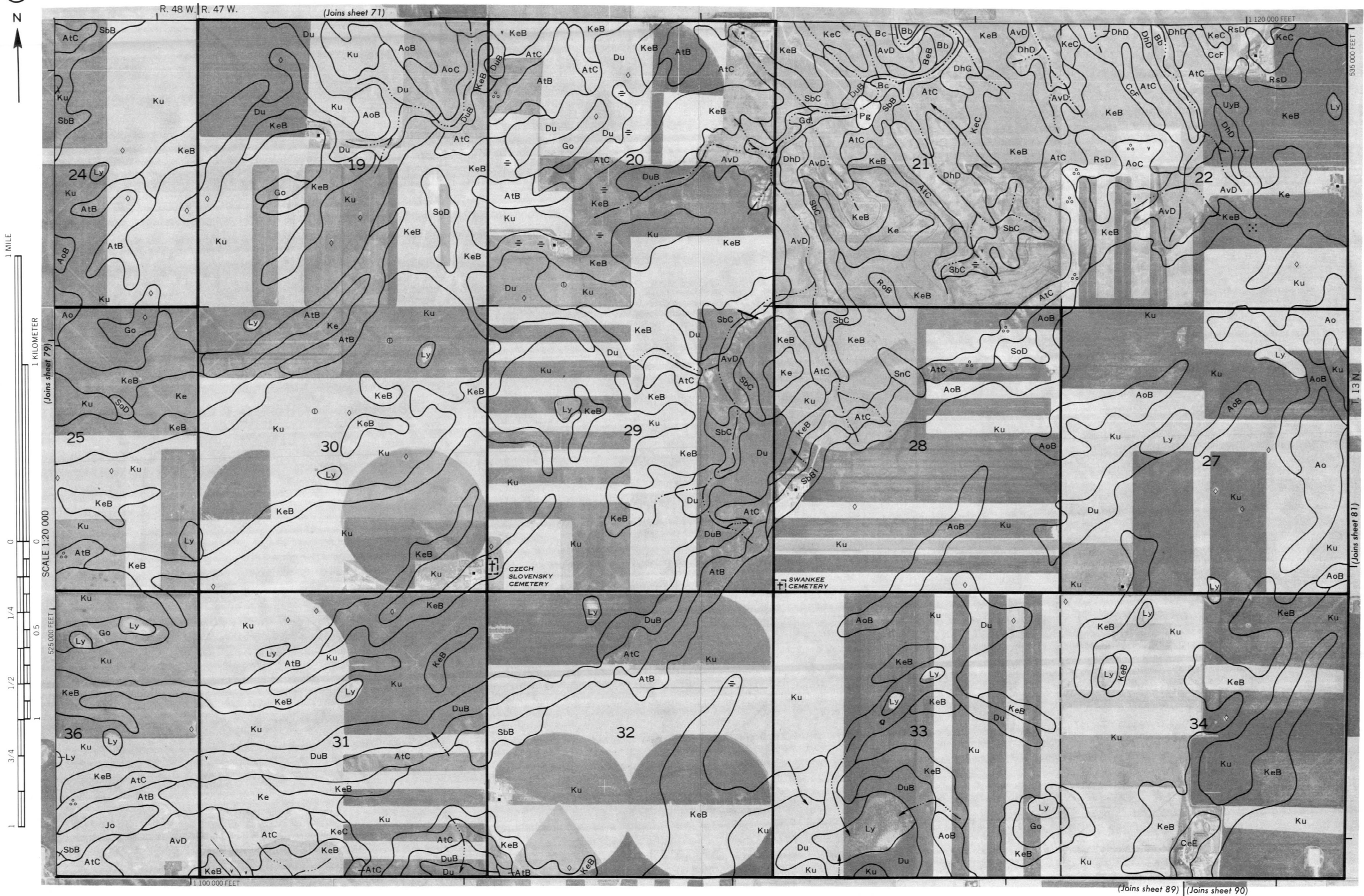
CHEYENNE COUNTY, NEBRASKA NO. 78

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

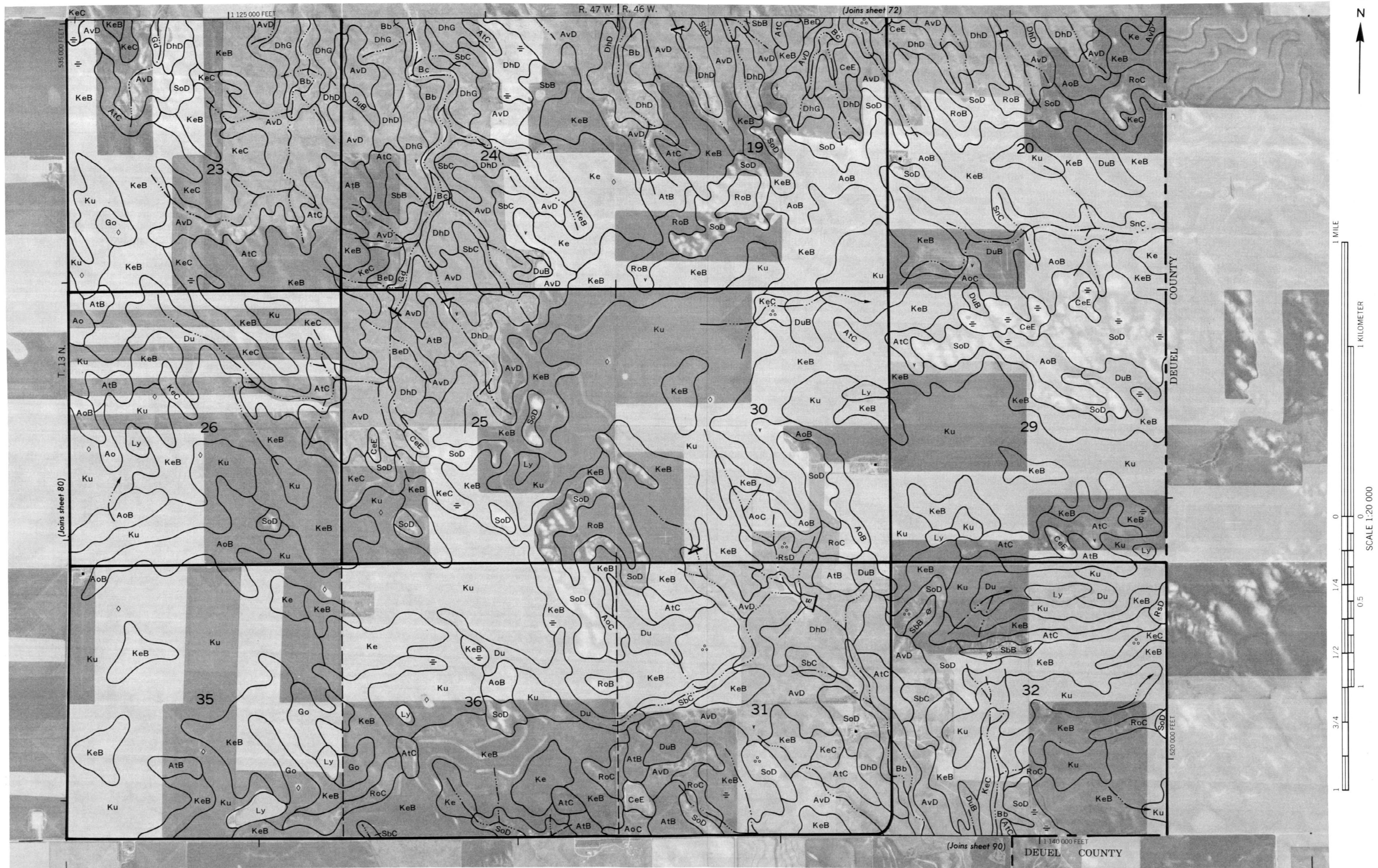
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

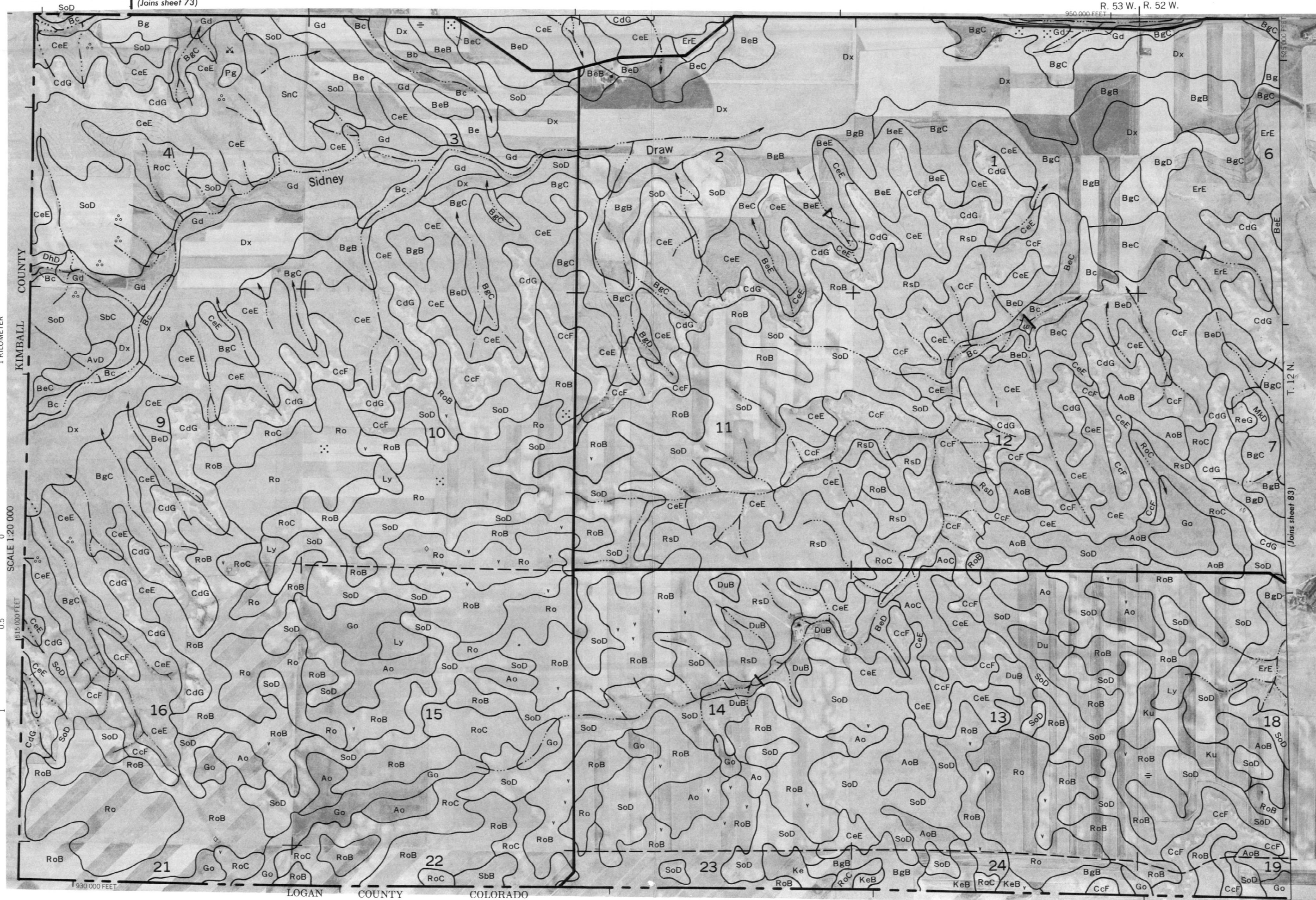
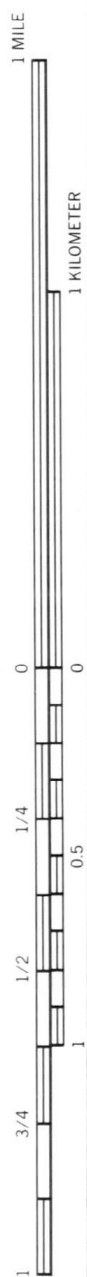
CHEYENNE COUNTY, NEBRASKA NO. 79





CHEYENNE COUNTY, NEBRASKA NO. 81





R. 52 W.

E
1 MILE

1 KILOMETER

SCALE 1:20 000

		I/T
--	--	-----

0.5

2/T

3/4	
-----	--

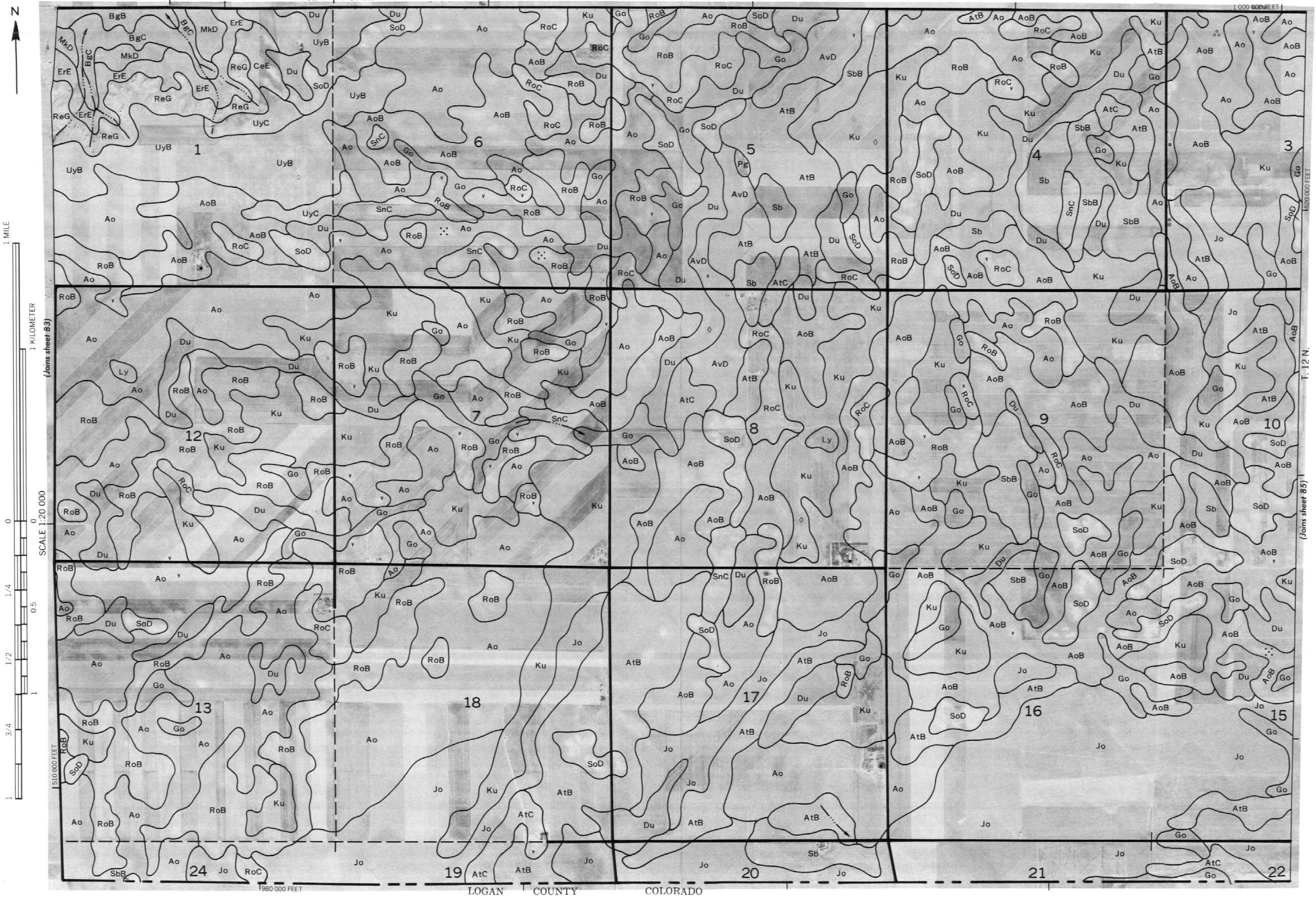
11

LOGAN COUNTY COLORADO

1975 000 FEET

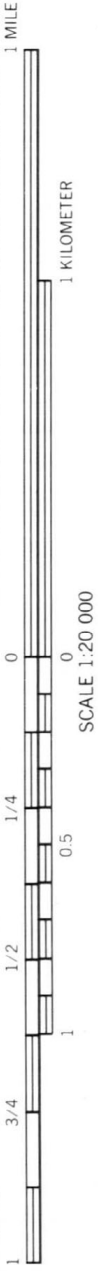
CHEYENNE COUNTY, NEBRASKA NO. 83

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

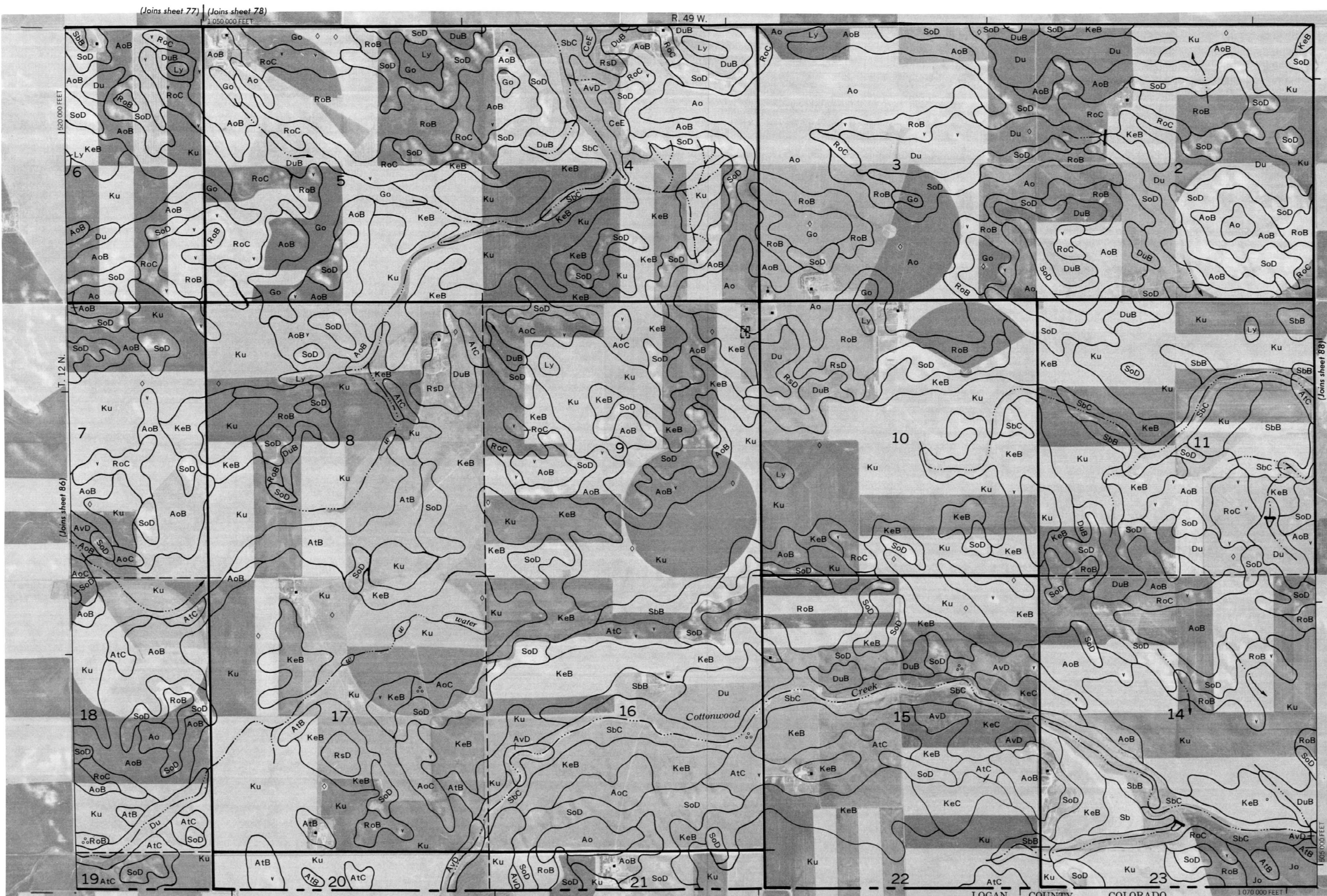
CHEYENNE COUNTY, NEBRASKA NO. 85

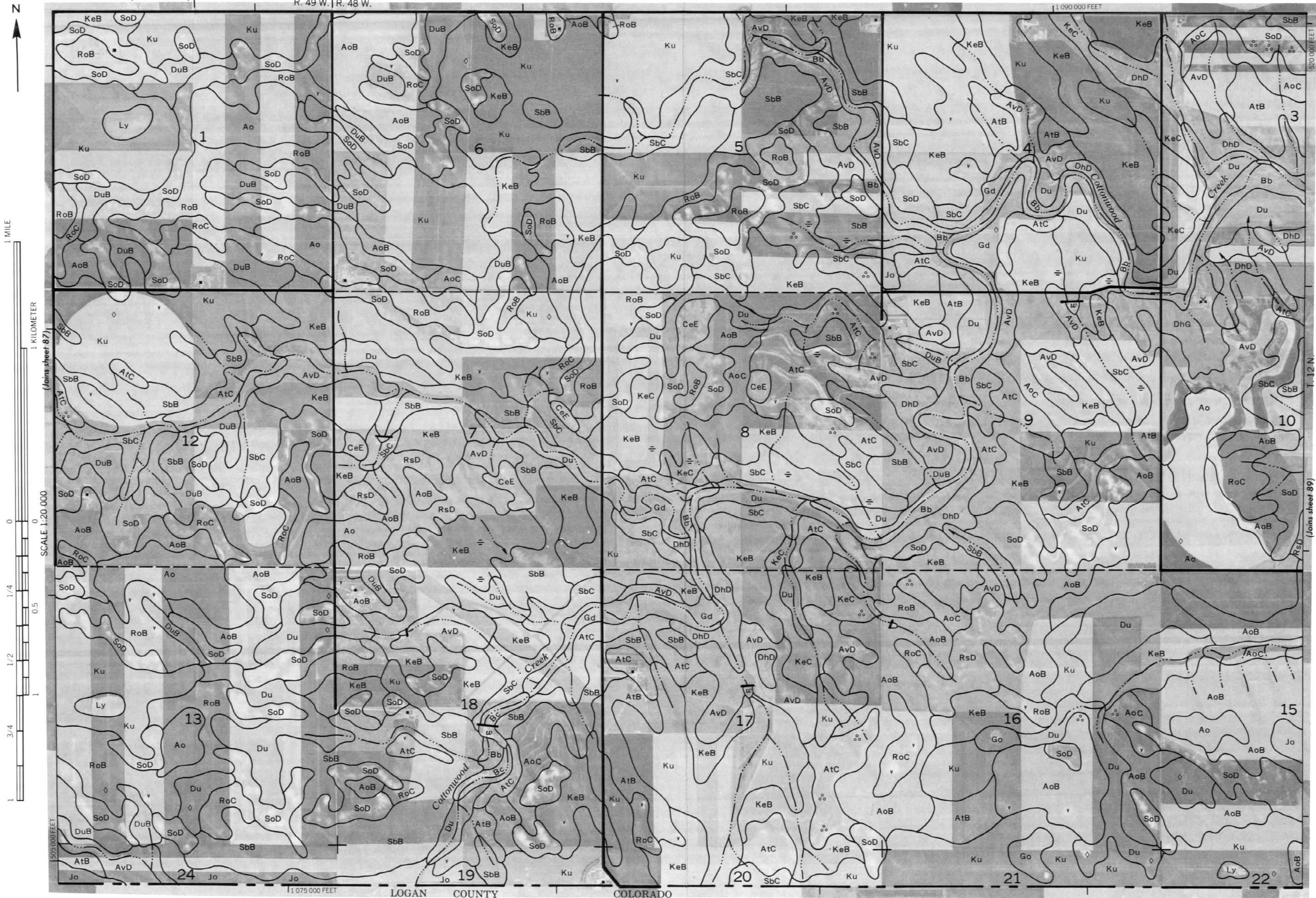




This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 87





This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEYENNE COUNTY, NEBRASKA NO. 89

